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DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1903

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

JOHN C. HOYT

PART I.—Northern Atlantic, St. Lawrence River, and Great Lakes Drainage

WASHINGTON

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ILLUSTRATION.

PLATE I. Map showing locations of principal gaging stations maintained during 1903 10

LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
Washington, D. C., March 23, 1904.

SIR: I have the honor to transmit herewith Water-Supply Paper, No. 97, which is Part I of a series of four papers numbered 97 to 100, inclusive. These papers compose the Report of Progress of Stream Measurements for the Calendar Year 1903. Parts I and II of this report contain the results of the data collected from the territory east of the Mississippi River. Parts III and IV are devoted to the data collected in the territory west of the Mississippi River.

The actual work of assembling the original data on which this report is based and also the preparation of the same for publication, has been done under the immediate direction of John C. Hoyt, who has been assisted by Frank H. Brundage, L. R. Stockman, R. H. Bolster, H. J. Saunders, and W. A. Brothers; acknowledgment is due these persons and also to the various resident hydrographers and others as mentioned on the following pages for the collection of the data herein presented.

In this connection special mention is due to R. E. Horton, resident hydrographer for New York and Michigan, who brought together and computed a large portion of the data collected at the stations in these two States, and to N. C. Grover, resident hydrographer for New England, for the descriptions of the stations in these States and for valuable suggestions in regard to various parts of the report.

Very respectfully,

F. H. NEWELL,
Chief Engineer.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1903.

PART I.

By JOHN C. HOYT.

INTRODUCTION.

During the calendar year 1903 the work of measuring the flow of streams has been continued on the same general lines as in previous years. Special efforts have been made during 1903 to collect such other additional information as will be of use in general hydrographic studies. Reconnaissances have been made on many of the important rivers in different portions of the United States and much valuable data in regard to floods, water powers, river profiles, etc., have been collected.

During 1903 the number of regular stations for stream measurements was steadily increased, so that at the close of the year systematic measurements were being carried on at approximately 500 stations. These are distributed so as to best cover the needs of the various States and Territories. (See Pl. I for location of principal gaging stations.) This expansion of the work is the result of the constantly increasing demand from the general and engineering public for the stream data collected by the Survey. The requests for information have been so numerous that the supply of publications containing the results has in many cases become exhausted.

The Survey has continued to receive the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the publication of many valuable records which could not otherwise have been obtained.

The Report of Progress of Stream Measurements for the Calendar Year 1903, of which this is Part I, is published in a series of four Water-Supply Papers, Nos. 97–100, inclusive, under the following subtitles:

Part I. Northern Atlantic, St. Lawrence, and Great Lakes drainage.

Part II. Southern Atlantic, eastern Gulf of Mexico, and eastern Mississippi River drainage.

Part III. Western Mississippi River and western Gulf of Mexico drainage.

Part IV. Interior Basin, Pacific, and Hudson Bay drainage.

The territory covered by each paper is given in the subtitle, and the larger drainages are, for convenience in arrangement, subdivided into smaller ones, under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon the observations and such other information that has been collected and that may be of use in hydrographic studies, including, as far as practicable, a description of the drainage area and the streams draining it.

For each regular station are given, as far as available, the following data:

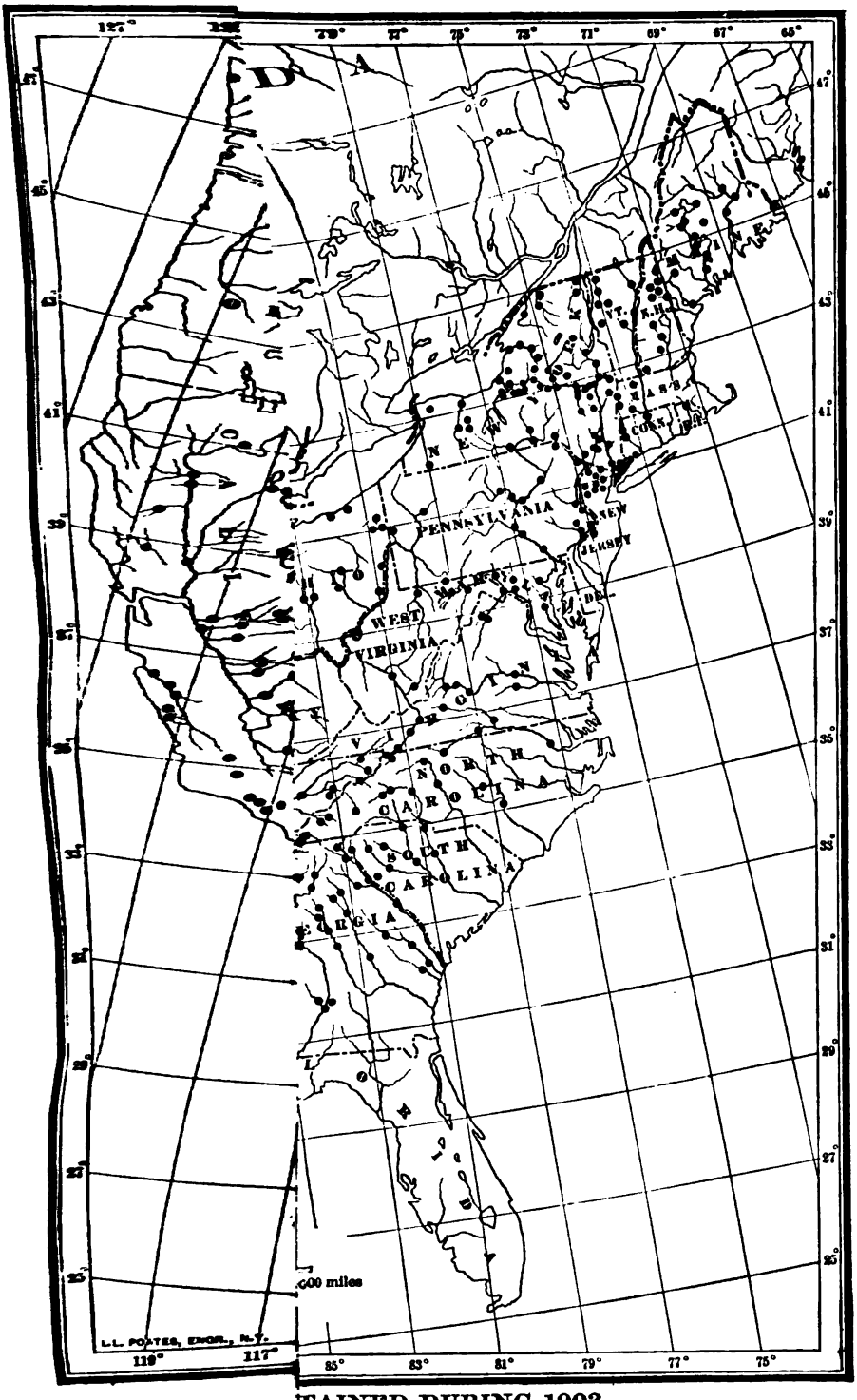
1. Description of station.
2. List of discharge measurements.
3. Gage height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and use the same. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge measurement table gives the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the fluctuations of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights. It depends on the general law that for streams of practically constant cross section the discharge is a function of the gage height, and that like gage heights will have the same discharge. In its preparation the discharge measurements are plotted on cross-section paper to some convenient scale, using gage heights as ordinates and discharges as abscissæ. Through these points a smooth curve is drawn, which is the basis for the table. From this curve are tabulated, on forms prepared for the purpose, the discharges corresponding to each tenth of a foot on the gage. The first and second differences between the successive discharges are then taken. These are adjusted on the assumption that



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there is a gradual increase in the discharge as the gage height increases, and the discharge values in the table are then adjusted according to these revised differences. In preparing the rating table all available data are brought into use, including special conditions which might affect the discharge. For high waters above the stage covered by discharge measurements, the general rule is to extend the curve by a line tangent to the curve. In case the river overflows its banks a per cent of the discharge is added depending on the depth and velocity of the overflowed portion. For stages below that portion of the curve which is fixed by discharge measurements, the curve has been extended, following the general form of the determined lower portion. Notes under each rating table indicate those portions that are based on actual observation and those that are estimated.

From the rating table and daily gage heights a table giving the daily discharge of the stream is prepared. From this the table of estimated monthly and yearly discharges and run-off is computed. This latter table gives in condensed form a summary of the results obtained from the observations made during the year at the station. In order to explain this table the following definitions are given:

The term "second-feet" (sec.-ft.) is an abbreviation for "cubic feet per second." It is the number of cubic feet of water flowing by the gaging station every second. The column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the three remaining columns in the table are based.

The expression "second-feet per square mile" means the number of cubic feet of water flowing each second from every square mile of drainage area.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

An "acre-foot" is the quantity of water that would cover an acre to the depth of one foot.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet," on the contrary, is merely a rate of flow, into which the element of time does not enter.

The results of the stream measurements performed during previous years by the United States Geological Survey can be found in the following Survey publications:

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47 to 52, inclusive; Twenty-second Annual Report, Part IV.
1901. Water-Supply Papers Nos. 65, 66, and 75.
1902. Water-Supply Papers Nos. 82 to 85, inclusive.
1903. Water-Supply Papers Nos. 97 to 100, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director, United States Geological Survey. Other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at nominal cost. Copies of Government publications are, as a rule, furnished to the public libraries in our large cities, where they may be consulted by those interested.

ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged geographically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

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Maryland.—Resident hydrographer, E. G. Paul, assisted by W. C. Sawyer. Acknowledgment is due to the State geological survey for cooperation in the work to the extent of paying the observers on the smaller Maryland streams.

Massachusetts.—Frederick P. Stearns, chief engineer, and C. W. Sherman, division engineer of the Metropolitan Water Board, of Boston, for records of flow of Sudbury and Nashua rivers and Lake Cochituate, and R. A. Hale, principal assistant engineer of the Essex Company, Lawrence, Mass., for records of flow of Merrimac River at Lawrence, Mass.

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New Jersey.—The work in this State for the early part of the year was under the direction of resident hydrographer, R. E. Horton. During the latter part of the year it was under the direction of the district hydrographer, E. G. Paul, assisted by F. H. Tillinghast.

New York.—Resident hydrographer, R. E. Horton, assisted by C. C. Covert. Records have been furnished by the following: E. A. Fisher, city engineer, and John F. Skinner, special assistant engineer, Rochester, N. Y.; T. P. Yates, Waverly, N. Y.; Wm. S. Bacot, Utica, N. Y.; International Paper Company, Fort Edward, N. Y.; Schroon River Pulp and Paper Company, Warrensburg, N. Y.; Duncan Company,

R. P. Bloss, Mechanicville, N. Y.; George Beebe, deputy city engineer, Syracuse, N. Y. Special acknowledgment is made of the interest and assistance of Hon. Edward A. Bond, State engineer, and Wm. Pierson Judson, deputy State engineer.

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Wisconsin.—District hydrographer, E. Johnson, jr., assisted by L. R. Stockman, assistant engineer. Acknowledgment should also be made to Prof. L. S. Smith, of the engineering department of the University of Wisconsin, for material assistance rendered.

NORTHERN ATLANTIC COAST DRAINAGE.

ST. JOHN RIVER DRAINAGE BASIN.

St. John River drains the largest basin between St. Lawrence River on the north and Susquehanna River on the south. Its total drainage area is stated by Wells[a] to be 26,000 square miles, of which approximately 7,500 square miles lie in Maine, its basin occupying the whole northern portion of the State. The extreme headwaters lie in the mountainous region between Maine and Canada, at elevations of 1,500 and 2,000 feet; thence its waters flow at first generally northeasterly through Maine. From the point of junction of the northwest and southwest branches, where the river first takes its name, to its junction with St. Francis River, a distance of 90 miles, its course lies wholly in Maine, although a portion of the tributary area lies in Canada. In this distance Alleguash River is the only tributary of importance. Wells estimates the average slope in the 90 miles to be 1.6 feet per mile. From its junction with St. Francis River the St. John forms the northern boundary of Maine for 70 miles. Within this distance the slope is slightly greater than above, having been estimated to be 2.7 feet per mile, while the volume is considerably

[a] Wells, Walter, The water power of Maine, 1869.

augmented by two important tributaries—Fish River from the south and Madawaska River from the north. At the point where it leaves the State line the river has an elevation of about 420 feet above sea level and drains an area of 8,765 square miles, of which 4,670 square miles are in Maine and 4,095 square miles in Canada. Beyond this point it receives the waters of Aroostook and Meduxnekeag rivers, the basins of which are almost entirely in Maine, besides several smaller tributaries having their sources, and in some cases a large portion of their drainage basins, in the same State.

The underlying rock is generally deep and either calcareous or clay slate. The basin is well forested; large areas have never been touched by the ax, while other portions have been lumbered for pine only. Probably 85 to 90 per cent of the whole basin tributary to the river at the eastern boundary of Maine is in forest.

According to Wells, the ponds and lakes in this basin in Maine aggregate a total surface area of 314 square miles. Of this water surface 120 square miles, or 38 per cent, are tributary to Alleguash River (36 square miles of which have been diverted to Penobscot River); 60 square miles, or 19 per cent, are tributary to Aroostook River; and 80 square miles, or 25 per cent, are tributary to Fish River. At the outlets of several of these lakes dams have been built which store water to be used in transporting logs.

Prior to 1845, a canal was cut from Telos Lake in the Alleguash basin to Webster Lake in the Penobscot basin, and a dam was constructed between Chamberlain and Eagle lakes. Thus, by means of these artificial structures, Chamberlain Lake, with its drainage basin of 270 square miles, was made tributary to the Penobscot. This diversion of St. John water is still continued. During the log-driving season, which varies considerably in its duration, nearly all of the run-off from this area is thrown to the Penobscot, while during the remainder of the year the gates in the dam at Chamberlain Lake are opened and water is allowed to flow both ways. On account of the fact that the gates in the dam at the outlet of Chamberlain Lake are about 2 feet lower than those in the dam at Telos Lake, the flow from this basin to the St. John is greater than that to the Penobscot when the gates in both are open. As the surface of the lake is lowered the proportion flowing to the St. John increases until at extreme low water none flows to the Penobscot.

Both the upper St. John and Alleguash rivers are generally inaccessible. The middle portion, forming the northern boundary of the State, may be reached on the Canadian side at any point by the Temiscouata Railroad, or in Maine at Fort Kent and Van Buren by the Bangor and Aroostook Railroad, while the basins of Fish and Aroostook rivers are rendered easily accessible by means of the latter road.

The drainage areas of the stream and its principal tributaries are as follows:

Drainage areas of St. John River and principal tributaries.

River.	Locality.	Area.
		Square miles.
St. John	Below Allegash	4,320
Do	Eastern boundary of Maine	8,765
St. Francis	Mouth	580
Madawaska	do	1,085
Tobique	do	1,705
Alleguash	do	1,500
Fish	do	910
Do	Wallagrass	890
Aroostook	Mouth	1,585
Do	Fort Fairfield	1,510
Meduxnekeag	Mouth	520

No measurements of flow of St. John River have been published. The United States Geological Survey maintains gaging stations in this basin on Fish River at Wallagrass, Me., and on Aroostook River at Fort Fairfield, Me.

FISH RIVER AT WALLAGRASS, ME.

Fish River enters the St. John from the south at Fort Kent. It has a total drainage area of 910 square miles, all of which lies in Maine, and of which 80 square miles are water surface. The basin is very generally wooded, probably 75 or 80 per cent of its area being still in forest. Of the several available power sites one only is partly developed and used for the manufacture of lumber. The underlying rock is shale or slate, and in general is well covered by soil.

The gaging station at Wallagrass was established by N. C. Grover on July 29, 1903. It is located just below the outlet of Wallagrass Brook. The area of the drainage basin at this point is 890 square miles. A standard chain gage is attached to trees on the bank; length of chain, 39.75 feet. It is referred to bench marks as follows: (1) Copper bolt in ledge 600 feet downstream from gage; elevation, 11.73. (2) Nail driven in blazed birch tree 5 feet upstream from gage; elevation, 11.91 feet. Elevations refer to datum of gage. The measurements of flow are made from a cable located about 1,500 feet downstream from the gage, or by wading at low stages of the river. The channel is straight for 500 feet above and 300 feet below the cable, and is about 100 feet wide. The bed is permanent and of gravel. The depth increases gradually from either bank to a maximum at low water of 3.5 feet near the center. The current at the cable is generally strong. At extreme low water the observed mean velocity was 0.63 of a foot

per second. The banks are high and are not liable to overflow. The gage is read once a day by Eddie Michaud, a school teacher of Wallagrass.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Fish River at Wallagrass, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 18	F. E. Pressey	2.80	260
Do	do	2.80	261
October 20	do	2.40	148
Do	do	2.40	144
October 29	do	2.13	129
Do	do	2.06	109
November 12	do	2.50	200

Mean daily gage height, in feet, of Fish River at Wallagrass, Me., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1		4.10	3.20	(a)	2.10	17		3.30	2.70	(a)	2.80
2		4.00	3.10	(a)	2.10	18		3.40	2.70	(a)	2.80
3		4.00	2.80	(a)	2.10	19		3.40	3.20	(a)	2.80
4		3.90	(a)	(a)	2.10	20		3.60	2.70	(a)	2.80
5		3.90	2.80	(a)	2.20	21		3.60	2.60	2.20	2.90
6		3.70	2.80	(a)	2.30	22		3.60	2.70	2.10	2.80
7		3.70	2.70	(a)	2.30	23		3.60	2.70	2.20	2.80
8		3.70	3.10	(a)	2.30	24		3.50	2.50	2.20	2.80
9		3.60	2.80	(a)	2.40	25		3.50	2.50	2.10	2.80
10		3.60	3.00	(a)	2.40	26		3.40	2.50	2.00	2.80
11		3.50	3.00	(a)	2.70	27		3.40	2.40	2.00	2.80
12		3.50	2.80	(a)	2.70	28		3.30	2.30	2.20	2.80
13		3.50	2.90	(a)	2.70	29	4.30	3.20	2.30	2.00	2.80
14		3.50	2.80	(a)	2.70	30	4.30	3.30	2.30	2.00	(b)
15		3.40	2.80	(a)	2.70	31	4.30	3.20		2.10	
16		3.40	2.90	(a)	2.70						

a Below 2.0. b Frozen November 29 to December 31.

AROOSTOOK RIVER AT FORT FAIRFIELD, ME.

Aroostook River enters the St. John from the west near Aroostook Junction in the province of New Brunswick. It has a total drainage area of 1,585 square miles, of which 1,565 square miles lie in Maine. Probably 80 per cent of the whole basin is in forest. The underlying rock is usually slate. Lake storage is used for driving logs only. Water power is used in Presque Isle. The principal falls on the river, known as Aroostook Falls, lie in Canada.

This gaging station was established by N. C. Grover on July 31, 1903. It is located at the steel highway bridge in the village of Fort Fairfield. The drainage area at this point is 1,510 square miles. A standard chain gage is attached to the steel webbing of the upstream truss; length of chain 27.61 feet. It is referred to bench marks as follows: (1) Northwest corner of south abutment, elevation 22.43 feet. (2) Marked point on connection plate near gage, elevation 23.60 feet. Elevations refer to datum of gage. The initial point for soundings is on the right bank at the lower end of the inclined end post of the downstream truss. The channel is straight for at least 1,000 feet above and 1,000 feet below the station, and is about 350 feet wide, broken by three piers. The bed is of gravel and permanent. The banks are high and are not liable to overflow. The current is medium at low water and swift at high water; the least observed mean velocity was 0.74 of a foot per second, at gage height 3.31 feet. The depths are small at low water, averaging about 2 feet. The gage is read twice daily by C. C. Harvey.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Aroostook River at Fort Fairfield, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 31	N. C. Grover	3.70	785
September 10	do	3.31	270
October 27	F. E. Pressey	3.36	326

Mean daily gage height, in feet, of Aroostook River at Fort Fairfield, Me., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.65	3.50	3.25	3.30	3.90	17	.....	3.40	4.00	3.15	4.35	.....
2	.....	3.60	3.55	3.20	3.30	4.25	18	.....	3.50	3.80	3.20	4.05	.....
3	.....	3.60	3.65	3.15	3.40	4.40	19	.....	3.60	3.85	3.25	4.00	.....
4	.....	3.55	3.55	3.20	3.45	4.25	20	.....	3.55	3.80	3.45	4.00	.....
5	.....	3.60	3.45	3.15	3.50	4.20	21	.....	3.85	3.65	3.45	3.80	4.00
6	.....	3.50	3.40	3.10	3.55	4.10	22	.....	4.15	3.60	3.40	3.80	4.30
7	.....	3.50	3.35	3.10	3.75	4.10	23	.....	4.10	3.50	3.40	3.80	.....
8	.....	3.40	3.35	3.15	3.70	4.00	24	.....	4.05	3.40	3.40	3.75	.....
9	.....	3.40	3.30	3.20	3.70	4.00	25	.....	3.95	3.40	3.35	3.65	.....
10	.....	3.50	3.30	3.10	3.90	3.85	26	.....	3.80	3.35	3.30	3.75	.....
11	.....	3.40	3.30	3.05	3.95	3.35	27	.....	3.70	3.30	3.30	3.65	.....
12	.....	3.40	3.40	3.10	4.30	3.70	28	.....	3.80	3.30	3.30	3.65	.....
13	.....	3.45	3.35	3.15	4.00	3.85	29	.....	3.65	3.30	3.30	3.90	4.50
14	.....	3.85	3.40	3.20	4.40	4.00	30	.....	3.50	3.25	3.20	4.00	.....
15	.....	3.65	3.45	3.15	4.70	(a)	31	3.70	3.55	.....	3.25	.....	.....
16	.....	3.45	3.80	3.20	4.30	.....							

a Readings December 15 to 31 through ice.

ST. CROIX RIVER DRAINAGE BASIN.

St. Croix River is formed by two branches; one, known as the upper St. Croix or Chiputneticook River, is the outlet of Schoodic Lakes; the other, Kennebasis River, is the outlet of the western lakes of the area, known as Kennebasis Lakes. The upper St. Croix, with its tributary lakes, forms nearly half of the eastern boundary of Maine, separating that State from New Brunswick. The total drainage area of the main stream is about 1,630 square miles, of which 920 square miles are tributary to the great reservoir systems controlled by dams at Vanceboro and Princeton. The length of the stream from the headwaters to the mouth is 100 miles. The basin is, in general, lower than that of any of the larger streams of the State flowing into the Atlantic, its headwaters having an elevation of about 540 feet. The fall from Chiputneticook (the lower of the Schoodic Lakes) to tide water, a distance of 54 miles, is, however, 382 feet, or 7 feet to the mile. At a number of places where falls and rapids occur water power has been or can easily be developed.

The lake surface of the Upper St. Croix is approximately 50 square miles, and that of the West Branch 70 square miles in area, taking into account only the principal lakes and ponds. Indeed, above Vanceboro and Princeton, each branch of the river is simply a succession of lakes to almost the extreme headwaters. Wells estimated the total lake surface of the St. Croix as not less than 150 square miles, or nearly one-tenth of the total basin. The drainage area at various points on the river is given in the following table:

Drainage area of St. Croix River.

	Sq. miles.
Main river:	
Vanceboro dam, foot of the Schoodic Lakes	420
Little Falls	500
Immediately above mouth of West Branch	690
Immediately below mouth of West Branch	1,360
Spragues Falls	1,390
Calais, lower dam	1,530
Mouth of river, eastern border of town of Calais	1,630
West Branch:	
Princeton dam	500
Confluence with main river	670

A large proportion of the drainage basin is still covered with timber, and above Vanceboro and Princeton the region is for the most part wild and inacessible. The greater part of the timber land in this region is controlled by sawmill owners at Calais and St. Stephen. In 1898 the amount of lumber sawed annually had decreased from about 100 million feet to 25 million feet, and since then the number of sawmills has been greatly reduced. In 1901 the lumber sawed amounted to 28 million feet, showing that the rate of cutting has remained nearly constant during the last few years. There are on this stream favorable locations for paper and pulp mills, but arrangements would have to be made with the sawmill owners in order to obtain a supply of timber.

The river is navigable as far as Calais, except during two months of the year, when it is frozen. Calais has railroad connection with Bangor directly over the Washington County Railroad, and, by way of Vanceboro, over the Canadian Pacific and the Maine Central railroads. There is also a short road connecting Princeton with Calais. Above Princeton the transportation facilities are poor.

ST. CROIX RIVER AT SPRAGUES FALLS NEAR BARING, ME.

This station was established December 4, 1902, by F. E. Pressey. The drainage area at this point is 1,390 square miles. A standard chain gage is attached to the lower guard timber of the Washington County Railroad bridge; length of chain, 24.84 feet. It is referred to bench marks as follows: (1) The downstream corner of bridge seat on right abutment; elevation, 17.60 feet. (2) Copper bolt in bowlder on right bank about 200 feet downstream from the bridge; elevation, 15.98 feet. Elevations refer to the datum of the gage.

The measurements of flow are made from a car suspended on a steel cable stretched over the river about one-half mile above the bridge. The initial point for soundings is 60 feet from small pine tree near anchorage on right bank. The channel is straight for 100 feet above and 1,000 feet below the cable, and has an unbroken width of about 200 feet at ordinary stages. The banks are high and rocky, and the bed is rocky and permanent. The observed mean velocity at the cable has varied between 5.49 feet per second at gage height 9.70 feet and 1.29 feet per second at gage height 6.53 feet. The measurement at gage height 6.11 feet was made from the bridge to which the gage is attached; mean velocity, 1.41 feet per second. The gage is read twice daily by Simeon Phinney, section foreman on the Washington County Railroad, who resides in Baring, Me.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of St. Croix River at Spragues Falls near Baring, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 21	R. M. Conner	9.70	5,879
April 20	do	9.30	5,060
April 28	do	8.30	2,700
April 29	do	8.40	2,986
May 18	do	7.20	1,445
May 19	do	7.30	1,543
September 9	F. E. Pressey	6.53	787
Do	do	6.55	796
October 1	N. C. Grover	6.11	589

Mean daily gage height, in feet, of St. Croix River at Spragues Falls near Baring, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.00	8.90	.....	9.30	8.20	8.60	7.90	8.50	6.70	6.10	6.50	6.70
2	7.90	9.00	11.00	9.30	8.10	8.50	8.20	8.50	6.70	6.10	6.50	6.70
3	7.90	9.10	10.40	9.00	8.00	8.50	8.20	8.40	6.60	6.10	6.50	6.70
4	7.80	8.90	10.00	9.00	8.00	8.40	8.40	8.40	6.60	6.00	6.50	6.70
5	7.70	8.70	9.80	9.00	8.00	8.40	8.40	8.40	6.60	6.00	6.40	6.70
6	7.80	8.70	9.80	8.90	8.00	8.40	8.30	8.30	6.60	6.00	6.40	6.80
7	7.80	8.70	9.80	8.90	8.00	8.40	8.20	8.30	6.60	6.00	6.40	6.80
8	8.00	8.90	9.20	8.80	8.00	8.40	8.20	8.30	6.50	6.00	6.50	6.80
9	8.30	9.10	9.50	9.60	8.00	8.40	8.10	8.20	6.50	6.00	6.50	6.80
10	8.30	9.30	9.70	10.60	8.00	8.50	8.00	8.10	6.50	6.00	6.50	6.90
11	8.60	9.70	9.90	10.80	8.00	8.60	7.90	7.80	6.50	5.90	6.60	6.90
12	8.80	9.60	10.50	10.60	8.00	8.70	7.90	7.50	6.50	5.90	6.60	6.90
13	9.90	9.50	11.00	10.50	8.00	8.80	7.90	7.30	6.50	6.00	7.10	7.30
14	10.30	9.40	11.30	10.00	7.90	8.80	8.10	7.20	6.40	6.00	7.20	7.70
15	10.60	9.30	10.90	9.70	7.30	8.50	8.20	7.20	6.40	6.00	6.80	7.70
16	10.70	9.10	10.70	9.50	7.10	8.00	8.30	7.20	6.40	6.00	6.90	7.70
17	10.70	9.00	10.50	9.30	7.20	7.70	8.30	7.20	6.40	6.00	6.90	7.70
18	10.90	9.00	10.10	9.30	7.20	7.50	8.30	7.20	6.40	6.60	7.00	7.80
19	11.60	9.30	9.80	9.30	7.30	7.50	8.30	7.20	6.40	6.60	7.10	7.80
20	12.00	9.40	9.80	9.30	7.30	7.50	8.30	7.20	6.30	6.60	7.20	8.00
21	12.00	9.50	9.80	9.10	7.30	7.50	8.30	7.20	6.30	6.60	7.20	8.30
22	10.20	9.70	9.80	9.00	7.30	7.50	8.30	7.20	6.20	6.60	7.20	8.30
23	10.40	9.90	10.00	8.80	7.30	7.60	8.30	7.10	6.20	6.60	7.10	8.20
24	10.40	9.90	10.50	8.60	7.30	7.60	8.30	7.10	6.20	6.60	7.00	8.20
25	10.80	9.80	10.90	8.40	7.50	7.60	8.30	7.00	6.20	6.60	6.90	8.20
26	11.60	10.10	11.20	8.30	7.80	7.60	8.40	7.00	6.20	6.60	6.80	8.20
27	12.00	9.70	11.00	8.30	8.00	7.60	8.40	6.90	6.20	6.60	6.80	8.10
28	11.20	9.70	10.70	8.30	8.40	7.70	8.50	6.80	6.20	6.60	6.80	8.10
29	9.10	.....	10.00	8.40	8.70	7.70	8.50	6.80	6.10	6.60	6.80	8.10
30	9.00	.....	9.30	8.40	8.90	7.70	8.50	6.70	6.10	6.60	6.80	8.10
31	8.80	.....	9.30	.....	8.60	.....	8.50	6.70	.....	6.60	.....	8.10

Rating table for St. Croix River at Spragues Falls near Baring, Me., from December 4, 1902, to December 31, 1903.

Gage Height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.9	525	6.9	1,120	7.9	2,255	8.9	3,855
6.0	655	7.0	1,225	8.0	2,380	9.0	4,090
6.1	585	7.1	1,330	8.1	2,510	9.1	4,340
6.2	620	7.2	1,440	8.2	2,640	9.2	4,605
6.3	660	7.3	1,550	8.3	2,775	9.3	4,880
6.4	710	7.4	1,660	8.4	2,920	9.4	5,160
6.5	770	7.5	1,775	8.5	3,075	9.5	5,450
6.6	840	7.6	1,890	8.6	3,245	9.6	5,750
6.7	925	7.7	2,010	8.7	3,430	9.7	6,055
6.8	1,020	7.8	2,130	8.8	3,635	9.8	6,360

Tangent at 9.60 feet gage height. Differences above this point 305 per tenth. Table well determined.

Mean daily discharge, in second-feet, of St. Croix River at Spragues Falls near Baring, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,380	3,855	10,020	4,880	2,640	3,245	2,255	3,075	925	585	770	925
2	2,255	4,090	10,020	4,880	2,510	3,075	2,640	3,075	925	585	770	925
3	2,255	4,340	8,190	4,090	2,380	3,075	2,640	2,920	840	585	770	925
4	2,130	3,855	6,970	4,090	2,380	2,920	2,920	2,920	840	655	770	925
5	2,010	3,430	6,360	4,090	2,380	2,920	2,920	2,920	840	655	710	925
6	2,130	3,430	6,360	3,855	2,380	2,920	2,775	2,775	840	655	710	1,020
7	2,130	3,430	6,360	3,855	2,380	2,920	2,640	2,775	840	655	710	1,020
8	2,380	3,855	4,605	3,635	2,380	2,920	2,640	2,775	770	655	770	1,020
9	2,775	4,340	5,450	5,750	2,380	2,920	2,510	2,640	770	655	770	1,020
10	2,775	4,880	6,055	8,800	2,380	3,075	2,380	2,510	770	655	770	1,120
11	3,245	6,055	6,665	9,410	2,380	3,245	2,255	2,130	770	525	840	1,120
12	3,635	5,750	8,495	8,800	2,380	3,430	2,255	1,775	770	525	840	1,120
13	6,665	5,450	10,020	8,495	2,380	3,635	2,255	1,550	770	655	1,330	1,550
14	7,885	5,160	10,935	6,970	2,255	3,635	2,510	1,440	710	655	1,440	2,010
15	8,800	4,880	9,715	6,055	1,550	3,075	2,640	1,440	710	655	1,020	2,010
16	9,105	4,340	9,105	5,450	1,330	2,380	2,775	1,440	710	655	1,120	2,010
17	9,105	4,090	8,495	4,880	1,440	2,010	2,775	1,440	710	655	1,120	2,010
18	9,715	4,090	7,275	4,880	1,440	1,775	2,775	1,440	710	840	1,225	2,130
19	11,850	4,880	6,360	4,880	1,550	1,775	2,775	1,440	710	840	1,330	2,130
20	13,070	5,160	6,360	4,880	1,550	1,775	2,775	1,440	660	840	1,440	2,380
21	13,070	5,450	6,360	4,340	1,550	1,775	2,775	1,440	660	840	1,440	2,775
22	7,580	6,055	6,360	4,090	1,550	1,775	2,775	1,440	620	840	1,440	2,775
23	8,190	6,665	6,970	3,635	1,550	1,890	2,775	1,330	620	840	1,330	2,640
24	8,190	6,665	8,495	3,245	1,550	1,890	2,775	1,330	620	840	1,225	2,640
25	9,410	6,360	9,715	2,920	1,775	1,890	2,775	1,225	620	840	1,120	2,640
26	11,850	7,275	10,630	2,775	2,130	1,890	2,920	1,225	620	840	1,020	2,640
27	13,070	6,055	10,020	2,775	2,380	1,890	2,920	1,120	620	840	1,020	2,510
28	10,630	6,055	9,105	2,775	2,920	2,010	3,075	1,020	620	840	1,020	2,510
29	4,340	.....	6,970	2,920	3,430	2,010	3,075	1,020	585	840	1,020	2,510
30	4,090	.....	4,880	2,920	3,855	2,010	3,075	925	585	840	1,020	2,510
31	3,635	.....	4,880	.....	3,245	.....	3,075	925	.....	840	.....	2,510

Estimated monthly discharge at St. Croix River at Spragues Falls near Baring, Me., for 1902 and 1903.

[Drainage area, 1,390 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
December	6,055	1,120	3,260	2.35	2.45
1903.					
January	13,070	2,010	6,463	4.65	5.36
February	7,275	3,430	4,998	3.60	3.75
March[a]	10,935	4,605	7,684	5.53	6.37
April	9,410	2,775	4,834	3.48	3.88
May	3,855	1,330	2,206	1.59	1.83
June	3,635	1,775	2,525	1.82	2.03
July	3,075	2,255	2,714	1.95	2.25
August	3,075	925	1,836	1.32	1.52
September	925	585	725	.52	.58
October	840	525	723	.52	.60
November	1,440	710	1,029	.74	.83
December	2,775	925	1,837	1.32	1.52
The year	13,070	525	3,131	2.25	30.52

[a] March 1, discharge estimated.

MACHIAS RIVER DRAINAGE BASIN.

The Machias may be taken as fairly representative of several of the smaller streams of Maine which empty their waters directly into the ocean, and which are commonly referred to as "coastal rivers." Its total drainage basin is 495 square miles, nearly all of which lies in Washington County, Me. Its extreme headwaters lie at an elevation of nearly 500 feet, and are not more than 50 miles from tide water. Wells listed 20 lakes in this basin, aggregating 29.5 square miles in area of water surface. Without important exception these lie, however, in the extreme headwaters. Dams are maintained at several of the outlets of the lakes, and the stored water is used for log driving. The underlying rock is usually granite. Probably 70 to 80 per cent of the basin is still in forest.

MACHIAS RIVER AT WHITNEYVILLE, ME.

This gaging station was established October 17, 1903, by F. E. Pressey, at the bridge of the Washington County Railroad, near Whitneyville. The drainage area at this point is 465 square miles. A standard chain gage is attached to the guard timber on the downstream side of the bridge; length of chain, 25.34 feet. It is referred to the following described bench marks: (1) Copper bolt in outcropping ledge on upstream side of railroad track and 170 feet from the face of left abutment; elevation, 20.12 feet. (2) Downstream outer corner of bridge seat of right abutment; elevation, 18.05 feet. (3) Marked point on floor beam of bridge at zero end of gage; elevation, 23.89 feet. Elevations refer to datum of the gage. The initial point for soundings is on the left bank at the lower end of the inclined end post of the downstream truss. The velocity is small at low water. Meter measurements may be made by wading at a point 200 feet above the bridge at low stages of the river. The water is confined to one channel at the bridge at all stages; the width is about 130 feet.

A short distance above the station is a dam which stores water for use by the mills in Machias. The gates in this dam are opened and closed each day during low stages of the river. As a result the river fluctuates as much as 0.5 of a foot on the gage. The bed is sandy, but permanent. The gage is read twice daily by George McKenzie, a farmer of Whitneyville.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

In 1903 a discharge measurement was made at this station by F. E. Pressey as follows:

October 17: Gage height, 6.63 feet; discharge, 221 second-feet.

Mean daily gage height, in feet, of Machias River at Whitneyville, Me., for 1903.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		6.95	7.40	12		8.25	8.50	23	7.55	7.65	8.55
2		6.90	7.40	13		8.20	8.50	24	7.50	7.85	8.25
3		6.95	7.50	14		8.20	8.65	25	7.50	7.75	8.10
4		7.35	7.40	15		8.10	8.75	26	7.45	7.45	7.95
5		7.80	7.50	16		7.90	8.20	27	7.40	7.00	7.85
6		7.55	7.45	17		8.00	7.90	28	7.25	7.05	7.55
7		7.70	7.35	18	7.90	8.50	7.55	29	6.95	7.05	7.35
8		7.80	7.30	19	8.50	8.70	7.25	30	6.70	7.05	7.45
9		7.90	7.30	20	8.25	8.45	7.35	31	6.60		7.25
10		7.80	7.55	21	7.65	7.55	7.90				
11		7.70	8.35	22	7.50	7.55	8.55				

PENOBSCOT RIVER DRAINAGE BASIN.

This basin, which has a total area of 8,500 square miles, lies wholly in Maine. It extends from the Atlantic Ocean on the south to the basin of the St. John on the north, a distance of 160 miles; and from the New Brunswick boundary on the east to the Quebec boundary on the west, a distance of 115 miles. The general elevation of the basin is lower than that of the drainage basins to the west. The headwaters of the main river lie in the mountainous region on the boundary of Quebec at an elevation of nearly 2,000 feet. The slopes of the upper tributaries are generally steep. Chesuncook Lake lies near the center of the basin at an elevation of 900 feet. From this point to tidewater, the distance along the river is about 115 miles, indicating an average slope of 7.8 feet to the mile. This is concentrated at intervals by ledges where water power has been or may be developed. The water from 800 square miles of the basin is discharged into the main river below its lowest available water power at Bangor.

Taken as a whole, the basin is rather uniform in its topographic features. Hills and low mountains stretch from near the sea to above Bangor; farther north is an undulating plain, while to the west the surface becomes more broken and is greatly diversified by hills, detached peaks, lakes, ponds, and swamps. At the south the basin merges into that of the Kennebec, and at the north into that of the Alleguash, terminating on the northwest, at the boundaries of the State, in a region of highland intermingled with swamps and lagoons. The whole northern basin of the main river and its tributaries is in forest. Original growth covers a large portion of this area, and in general, wherever cuttings have been made, a dense second growth has sprung up. Extensive areas in the southern basin have been cleared and converted into farms. Probably 70 to 80 per cent of the whole basin above Bangor is in forest. Throughout the upper portion of the basin slate is the principal outcropping rock, being succeeded to the east and south by schists, gneiss, and granite; the soil is mainly clay, gravel, and loam.

The drainage area of the river and its chief tributaries are given in the following table:

Drainage areas of Penobscot River and principal tributaries.[a]

River.	Locality.	Drainage area.
		Square miles.
Penobscot	Opposite northwest extremity of Moosehead Lake, township of Seboomook, immediately below mouth of Nulhedus Creek.	510
Do	Entrance into Chesuncook Lake	850
Do	Outlet of Chesuncook Lake	1,450
Do	Millinocket, outlet of Twin Lakes	1,880
Do	Immediately below mouth of east branch of Penobscot.[a]	3,260
Do	Immediately below mouth of Mattawamkeag.[a]	4,940
Do	Montague, immediately below mouth of Piscataquis.[a]	6,630
Do	Sunk Haze Rips[a]	7,260
Do	Old Town, above mouth of Pushaw River[a]	7,340
Do	Bangor, above mouth of Kenduskeag River[a]	7,720
Do	Mouth[a]	8,550
Cauquomogomoc	Entrance into Chesuncook Lake	230
East branch of Penobscot	Grindstone[a]	1,130
Do	Mouth[a]	1,160
Mattawamkeag	Immediately below outlet of Baskahegan Lake	190
Do	Mouth	1,510
Piscataquis	Low's Bridge	280
Do	Dover	330
Do	Mouth	1,500
Passadumkeag	do	400

[a] Includes Chamberlain Lake basin (270 square miles). See description of St. John drainage basin.

The United States Geological Survey now maintains gaging stations at the following places in the Penobscot basin: On the Penobscot at Montague; on Piscataquis River at Low's Bridge, near Foxcroft; on Mattawamkeag River at Mattawamkeag; on the east branch of Penobscot River at Grindstone.

PENOBSCOT RIVER AT MILLINOCKET, ME.

The discharge of the Penobscot at Millinocket has been computed from data furnished by H. S. Ferguson, engineer for the Great Northern Paper Company. These results were obtained by adding to the flow through the wheels the flow over the dam. The wheels were rated at Holyoke, Mass., before being placed in position. As the head under which they worked, averaging about 110 feet, is much greater

than the head under which they were tested, several tube float measurements of the flow in the canal leading to the mill have been made by Mr. Ferguson in order to determine just how much water the mill uses under different conditions of gate openings. By means of these measurements it is believed that a very good estimate has been made of the flow through the wheels. The dam is of concrete, resting on rock, and does not leak. The flow over it was computed by use of the formula $Q=c\,b\,H^{\frac{3}{2}}$, in which c is a variable coefficient obtained from a study of the results of experiments made by George W. Rafter at the Cornell testing flume.

When the flow of the river is less than 2,500 second-feet all of the water is generally used through the mill; at higher stages the excess is wasted over the dam. The flow over the flashboards, which are used whenever possible, is computed by use of the formula $Q=3.33\,b\,H^{\frac{3}{2}}$. The area of the drainage basin at Millinocket is 1,880 square miles. Several dams, which have been constructed at points in the basin above this point, store water on a surface of practically 80 square miles. This water is used for log driving and for manufacturing purposes.

Mean daily discharge, in second-feet, of Penobscot River at Millinocket, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.[a]	Dec.
1	1,740	1,210	890	24,250	10,340	1,680	2,670	2,330	2,500	1,380	50	50
2	1,750	1,140	1,130	24,250	11,060	2,290	2,540	5,800	3,060	1,410	510	50
3	1,740	2,280	2,040	22,550	10,610	2,160	2,440	1,410	3,340	1,350	510	50
4	740	2,310	1,810	20,930	11,670	2,510	1,570	2,520	2,430	830	520	50
5	1,240	2,020	1,960	20,470	12,290	2,440	1,020	2,550	2,480	1,190	510	50
6	1,780	2,120	2,160	19,630	10,330	2,370	1,910	2,520	1,500	400	520	50
7	1,720	2,220	2,130	21,710	9,790	1,230	2,380	2,350	410	990	580	50
8	1,690	1,460	750	17,850	9,290	1,220	2,160	2,460	1,120	990	240	230
9	1,770	1,130	1,210	12,590	10,400	2,350	3,190	6,550	2,330	980	530	550
10	1,820	2,140	1,790	10,960	10,650	2,350	3,260	1,340	2,390	990	510	650
11	810	2,220	1,690	9,730	9,860	2,420	2,490	6,750	2,450	400	550	840
12	1,190	2,240	1,680	10,130	10,360	2,460	2,210	2,560	2,260	970	540	570
13	1,990	2,200	1,900	9,120	9,390	2,510	1,360	2,550	1,970	960	680	360
14	1,690	2,210	4,400	9,760	6,930	1,280	3,340	5,050	1,790	950	550	540
15	1,660	1,070	1,830	9,800	5,940	1,610	2,450	5,430	2,460	860	50	560
16	1,720	1,100	1,440	9,680	5,940	2,450	2,540	4,430	1,840	900	580	750
17	1,720	2,160	2,780	9,760	8,310	2,410	2,480	4,800	2,310	750	960	670
18	790	2,180	2,210	9,700	4,970	2,520	2,540	6,100	2,120	460	570	530
19	1,050	2,080	2,490	9,470	5,370	2,550	2,290	5,500	2,200	720	750	570
20	2,050	2,120	2,890	9,600	2,430	2,560	2,360	5,910	1,410	730	730	550
21	2,070	2,190	2,960	10,920	2,430	1,900	1,400	3,780	1,240	710	570	560
22	1,980	1,000	5,680	10,900	2,280	750	2,500	2,240	2,430	730	50	890
23	1,720	1,190	4,460	10,870	2,410	2,610	2,550	1,300	2,090	630	50	960
24	1,640	2,140	6,150	10,820	1,670	2,540	2,550	1,830	1,790	640	50	510
25	460	1,900	10,390	10,520	1,520	2,470	2,500	2,470	1,750	230	50	50
26	1,220	1,940	14,960	9,100	2,410	2,530	5,170	2,650	1,780	630	50	50
27	2,220	1,850	17,030	12,340	2,360	2,420	2,000	2,720	690	600	60	400
28	2,160	2,170	17,810	10,780	2,470	1,220	2,460	2,610	760	570	180	430
29	2,330	.....	19,580	11,030	2,390	1,290	2,580	2,380	1,160	490	50	600
30	2,330	.....	19,790	10,340	2,480	2,400	2,410	1,720	1,390	510	50	570
31	1,610	.....	20,960	.....	1,610	.....	1,990	660	.....	520	.....	560

[a] Mill shut down November 1, 5, and 22 to December 6, inclusive, and December 25 and 26.

PENOBSCOT RIVER AT MONTAGUE, ME.

This station was established by N. C. Grover on November 5, 1901. It is located at the steel highway bridge, about 1,000 feet below the mouth of Piscataquis River. The drainage area at this point is 6,630 square miles, including the area of the drainage basin of Chamberlain Lake (270 square miles), which flows into the Penobscot part of the year only.[a] The measurements are made from the bridge. A standard chain gage is fastened to the steel webbing on the upstream side of the bridge; length of chain, 34.49 feet. It is referred to bench marks as follows: (1) The top of the northwest corner of first course below bridge seat, easterly abutment; elevation, 25.78 feet. (2) Copper bolt in outcropping ledge under bridge, near east abutment; elevation, 6.71 feet. (3) Marked point on bottom chord of bridge, under gage; elevation, 29.52 feet. All elevations are above gage datum. The initial point for soundings is on the easterly abutment at the extreme end of the inclined end post on downstream side of bridge. The channel is straight for 1,000 feet above and 3,000 feet below the station, is about 870 feet wide, and is broken by four piers. The banks are high and rocky, and the bed permanent and rocky with some gravel. The observed mean velocity has varied from 5.05 feet per second at gage height 12.90 to 1.08 feet per second at gage height 1.54. Water power is used on both Penobscot and Piscataquis rivers within a mile above the station. Fluctuations at the gage of 0.2 or 0.3 of a foot during low water are caused by changes in gate openings at the mills above. The gage is read twice daily by A. H. Hanson, a merchant in Montague.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Penobscot River at Montague, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 14	F. Collins	6.65	17,594
May 25	Murphy & McCulloch	4.10	8,409
June 11	N. C. Grover	3.21	5,910
August 7	F. E. Pressey	3.22	6,141
October 15	N. C. Grover	1.54	2,066
October 23	F. E. Pressey	1.58	2,366

[a] See description of St. John drainage basin.

Mean daily gage height, in feet, of Penobscot River at Montague, Me., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	5.20	5.05	.....	14.50	9.70	6.25	7.40	5.25	2.15	2.90	6.60	4.10
2	3.95	5.05	.....	13.95	10.65	6.10	7.30	5.15	2.25	3.00	5.90	4.05
3	4.35	5.25	.....	13.35	10.20	6.15	7.35	4.95	2.90	2.85	5.20	3.70
4	4.50	5.10	.....	12.80	9.95	7.45	7.40	4.80	3.25	2.85	4.95	3.35
5	4.30	4.95	.....	12.25	9.70	9.20	7.30	5.05	3.10	2.75	5.05	3.70
6	4.10	4.90	.....	11.40	9.50	10.05	6.95	5.00	3.00	2.55	4.80	3.60
7	4.05	4.80	.....	11.05	9.40	10.15	6.55	4.90	2.95	3.10	4.35	3.50
8	3.60	4.70	.....	10.85	9.30	10.00	6.10	5.00	2.70	3.70	4.15	4.80
9	3.65	(a)	.....	10.65	9.40	11.90	6.05	5.10	2.25	3.95	3.95	(a)
10	3.50	.....	.....	10.80	9.00	12.20	5.85	4.95	2.90	3.85	3.70	.....
11	3.00	.....	.....	11.05	8.65	11.45	5.60	4.80	3.45	3.65	3.85	.....
12	2.90	.....	.....	11.15	8.30	10.90	5.05	5.20	3.65	3.10	3.90	.....
13	2.80	.....	.....	9.95	8.00	10.40	5.20	6.05	3.45	3.05	3.95	.....
14	2.85	.....	.....	10.70	7.60	10.00	5.95	6.25	3.55	2.85	4.00	.....
15	2.70	.....	.....	10.35	7.25	9.60	5.10	6.40	3.80	3.10	4.10	.....
16	2.60	.....	.....	10.30	6.90	9.05	4.60	4.80	3.65	2.95	4.20	.....
17	2.45	.....	.....	10.15	6.60	8.40	4.70	4.45	3.50	3.00	4.05	.....
18	2.20	.....	.....	9.95	6.50	8.05	4.75	3.65	3.40	2.95	4.10	.....
19	2.45	.....	.....	9.45	6.50	7.65	4.90	3.55	3.30	2.80	4.25	.....
20	2.20	.....	.....	8.65	6.25	7.05	5.05	4.20	3.15	2.75	4.20	.....
21	2.55	.....	.....	8.75	5.95	6.40	5.70	4.55	3.15	3.30	4.10	.....
22	2.60	.....	.....	9.00	6.15	6.35	5.90	4.50	3.20	3.90	4.10	.....
23	3.80	.....	.....	8.90	6.35	7.60	5.65	4.30	3.15	3.70	4.10	.....
24	6.20	.....	.....	8.80	6.70	7.50	4.75	4.15	3.10	3.30	3.85	.....
25	6.55	.....	.....	8.90	6.70	7.15	4.50	3.40	3.05	3.05	3.85	.....
26	5.55	.....	.....	9.00	6.85	7.10	4.60	3.50	3.00	2.85	4.05	.....
27	5.75	.....	.....	9.05	6.75	9.45	4.35	3.75	2.90	2.85	3.80	.....
28	6.10	.....	12.70	9.25	6.70	9.75	4.85	3.80	2.75	3.70	3.85	.....
29	6.25	.....	12.70	9.25	7.00	8.55	5.65	3.50	2.60	7.70	4.30	.....
30	5.55	.....	14.45	9.20	6.95	7.95	5.70	3.25	2.75	8.00	4.20	.....
31	5.65	.....	15.00	.....	6.60	.....	5.60	2.75	.....	7.40	.....	.....

a Frozen February 9 to March 27, and December 9 to 31.

Mean daily gage height, in feet, of Penobscot River at Montague, Me.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	11.15	8.25	3.60	3.25	4.35	3.15	1.70	1.40	1.80
2	.....	.....	.....	10.90	7.80	3.90	3.30	3.95	3.20	1.60	1.50	1.70
3	.....	.....	.....	10.75	7.35	3.70	3.30	3.70	3.10	1.50	1.55	1.60
4	.....	.....	.....	10.90	7.35	3.40	3.20	3.45	3.25	1.55	1.45	1.65
5	.....	.....	.....	11.45	7.40	3.15	3.35	3.35	2.95	1.50	1.40	1.70
6	.....	.....	.....	11.15	7.15	3.15	3.65	3.25	2.70	1.40	1.30	1.70
7	.....	.....	.....	10.80	7.05	2.80	3.25	3.20	3.00	1.45	1.30	1.60
8	.....	.....	.....	10.80	6.70	2.60	3.45	3.10	3.05	1.45	1.45	1.60
9	.....	.....	.....	11.45	6.85	2.55	3.85	3.15	2.90	1.45	1.70	1.65
10	.....	.....	.....	12.05	6.85	3.10	4.45	3.20	3.00	1.30	1.60	1.70
11	.....	.....	(a)	11.80	6.75	3.05	4.65	3.25	2.75	1.30	1.60	1.70
12	.....	.....	17.55	11.20	6.80	3.20	4.10	3.75	2.60	1.20	1.75	1.85
13	.....	.....	13.30	10.75	6.70	3.65	3.65	3.60	2.70	1.40	2.20	2.40
14	.....	.....	13.10	10.40	6.65	4.75	3.45	3.40	2.60	1.50	2.55	2.50
15	.....	.....	11.80	10.15	6.10	5.55	3.80	3.50	2.65	1.50	2.60	(b)
16	.....	.....	11.90	9.90	5.90	4.25	3.60	3.60	2.80	1.50	2.60	.....
17	.....	.....	11.25	9.65	5.70	4.10	4.20	3.55	2.65	1.60	2.50	.....
18	.....	.....	10.80	9.30	5.55	3.90	4.20	3.55	2.65	1.55	2.45	.....
19	.....	.....	10.30	9.15	5.35	3.85	3.80	3.65	2.55	1.60	2.25	.....
20	.....	.....	10.90	9.00	5.00	3.70	3.95	3.95	2.50	1.65	2.10	.....
21	.....	.....	11.40	8.60	4.80	3.55	3.80	4.25	2.60	1.70	2.00	3.30
22	.....	.....	11.60	8.30	4.75	3.20	3.60	4.30	3.45	1.65	1.90	.....
23	.....	.....	11.85	8.15	4.60	2.80	3.65	3.70	3.20	1.60	1.80	.....
24	.....	.....	12.40	8.15	4.30	3.15	3.60	3.30	2.35	1.65	1.80	.....
25	.....	.....	13.50	8.05	4.05	3.25	3.75	3.40	2.55	1.70	1.70	.....
26	.....	.....	13.40	8.15	4.05	3.10	3.70	3.30	2.20	1.80	1.80	.....
27	.....	.....	13.00	8.25	4.00	3.15	3.60	3.20	1.90	1.70	1.80	.....
28	.....	.....	12.45	8.15	4.00	3.25	3.30	3.10	1.95	1.60	1.80	3.10
29	.....	.....	11.80	8.25	3.85	3.30	3.65	3.20	2.00	1.50	1.70	.....
30	.....	.....	11.30	8.25	3.70	3.15	4.20	3.15	1.75	1.50	1.80	.....
31	.....	.....	11.15	.....	3.45	.....	4.90	3.10	.....	1.40	.....	.....

a River frozen January 1 to March 11.

b Readings through ice December 15 to 31.

Rating table for Penobscot River at Montague, Me., from November 5, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	1,600	2.7	4,680	4.4	9,270	7.4	21,330
1.3	1,760	2.8	4,930	4.6	9,860	7.6	22,420
1.4	1,930	2.9	5,190	4.8	10,470	7.8	23,550
1.5	2,110	3.0	5,450	5.0	11,120	8.0	24,720
1.6	2,300	3.1	5,720	5.2	11,800	8.2	25,910
1.7	2,490	3.2	5,990	5.4	12,510	8.4	27,130
1.8	2,690	3.3	6,260	5.6	13,260	8.6	28,380
1.9	2,890	3.4	6,530	5.8	14,030	8.8	29,650
2.0	3,090	3.5	6,800	6.0	14,820	9.0	30,930
2.1	3,300	3.6	7,070	6.2	15,630	9.2	32,220
2.2	3,520	3.7	7,340	6.4	16,480	9.4	33,530
2.3	3,740	3.8	7,610	6.6	17,370	9.6	34,860
2.4	3,970	3.9	7,880	6.8	18,300	9.8	36,220
2.5	4,200	4.0	8,150	7.0	19,270	10.0	37,600
2.6	4,440	4.2	8,700	7.2	20,280	10.2	39,000

Tangent at 10.5 feet gage height. Differences above this point 710 per tenth. Table well determined between 1.5 and 13.0 feet gage heights.

Estimated monthly discharge of Penobscot River at Montague, Me., for 1902 and 1903.

[Drainage area, 6,630 square miles.[a]]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
January	17,145	3,520	8,511	1.28	1.48
February 1–8[b]			11,050	1.67	.50
March 28–31			63,909	9.64	1.43
April	69,500	28,695	40,852	6.16	6.87
May	42,165	14,620	24,366	3.68	4.24
June	53,170	15,220	29,602	4.46	4.98
July	21,330	9,125	14,032	2.12	2.44
August	16,480	4,805	9,905	1.49	1.72
September	7,610	3,410	5,659	.85	.95
October	24,720	4,320	7,537	1.14	1.31
November	17,370	7,340	9,152	1.38	1.54
December 1–8[c]			7,765	1.17	.35

[a] Includes Chamberlain Lake drainage basin of 270 square miles. See description of St. John drainage basin.
[b] Frozen February 9 to March 27.
[c] Frozen December 9 to 31.

Estimated monthly discharge of Penobscot River at Montague, Me., etc.—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1903.					
March 12–31[a]			53,437	8.06	6.00
April	52,105	25,015	36,786	5.55	6.19
May	26,215	6,665	14,630	2.21	2.55
June	13,070	4,320	6,733	1.02	1.14
July	10,790	5,990	7,483	1.13	1.30
August	9,125	5,720	6,802	1.03	1.19
September	6,665	2,590	4,707	.71	.79
October	2,690	1,600	2,177	.33	.38
November	4,440	1,760	2,815	.42	.47
December 1–14[b]			2,699	.41	.21

[a] Frozen January 1 to March 11. [b] Frozen December 15 to 31.

EAST BRANCH OF PENOBSCOT RIVER AT GRINDSTONE, ME.

This station was established October 23, 1902, by F. E. Pressey. It is located at the Bangor and Aroostook Railroad bridge, one-half mile south of the railway station. The measurements are made from the railroad bridge. The drainage area at this point is 1,130 square miles, including the Chamberlain Lake basin (270 square miles).[a] The initia point for soundings is on the left bank, at the lower end of the inclined end post. The gage is of the standard chain type; length of chain, 31.99 feet. The scale board is nailed to the guard timber on the upstream side of the bridge. It is referred to the following-described bench marks: (1) Southwest corner of bridge seat on east abutment; elevation, 26.32 feet. (2) Copper bolt in ledge under north end of bridge; elevation, 8.78 feet. (3) Marked point on center stringer, near gage; elevation, 29.78 feet. All elevations are above gage datum. The channel both above and below this station is straight. The flow is moderately rapid at medium and high stages of the river. Observed mean velocities range from 2.27 feet per second at gage height 8.10 feet to 0.18 foot per second at gage height 4.32 feet. Fluctuations in stage are usually slow, as no water power is used on the river above the station. Dams are maintained at the outlets of several of the lakes and ponds near the source of the river, and the impounded water is used for log driving. The bed is rocky and permanent; the stream is confined to the channel by the abutments of the bridge, and has a width of about 275 feet, broken by one pier. Practically all

[a] See description of St. John drainage basin.

land areas in this basin are in forest. The gage is read twice daily by Harry Stinson.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of East Branch of Penobscot River at Grindstone, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 9	N. C. Grover	7.85	4,673
April 14	do	8.10	5,347
April 22	F. E. Pressey	7.20	3,232
May 23	C. N. McCulloch	6.64	2,577
September 9	N. C. Grover	4.32	223
September 26	do	5.36	824
October 28	F. E. Pressey	4.58	474

Mean daily gage height, in feet, of East Branch of Penobscot River at Grindstone, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7.85	8.20	5.70	5.00	7.60	4.50	4.80	4.50	.....
2	.....	7.55	8.05	5.65	5.00	7.40	4.50	4.65	4.50	.....
3	.....	7.60	7.85	5.70	5.00	7.45	4.50	4.50	4.50	.....
4	.....	8.25	7.70	5.65	5.00	7.40	4.50	4.50	4.50	3.70
5	.....	8.30	7.15	5.60	5.00	7.25	4.50	4.50	4.55	.....
6	.....	7.90	6.70	5.60	5.05	7.10	4.50	4.50	4.75	.....
7	.....	7.65	6.45	5.60	6.20	7.10	4.40	4.40	4.80	3.70
8	.....	7.50	6.75	5.50	6.50	7.10	4.30	4.25	4.80	.....
9	.....	7.90	7.45	5.50	6.35	7.15	4.30	4.10	4.80	.....
10	.....	8.40	7.20	5.50	6.70	7.05	4.30	4.10	4.80	.....
11	.....	8.40	7.20	4.90	7.40	6.70	4.30	4.10	4.90	.....
12	.....	8.30	7.10	5.40	6.25	6.15	4.30	4.10	5.10	.....
13	.....	8.20	7.20	6.00	5.40	6.00	4.30	4.40	5.45	3.90
14	.....	8.10	7.50	6.80	5.40	5.85	4.40	4.40	5.40	.....
15	.....	8.10	8.10	6.20	5.90	5.70	4.40	4.30	5.25	.....
16	.....	8.30	8.20	5.60	7.40	5.55	4.40	4.30	5.20	.....
17	.....	8.20	8.35	5.40	7.90	4.90	4.50	4.20	5.10	.....
18	.....	7.55	8.40	5.25	7.85	4.70	4.50	4.50	5.10	.....
19	.....	7.30	8.20	5.40	7.80	4.60	4.50	4.90	4.95	.....
20	.....	7.00	7.10	5.30	7.90	4.90	6.20	4.75	4.75	4.0
21	.....	6.90	7.10	5.30	7.90	5.70	6.20	4.55	4.60	.....
22	.....	7.00	6.85	5.30	7.80	5.25	6.10	4.50	4.60	.....
23	.....	7.15	6.60	5.30	7.45	5.05	5.95	4.50	4.45	.....
24	(a)	7.10	5.90	5.30	6.30	4.80	5.80	4.50	4.35	.....
25	10.00	7.30	5.40	5.30	6.05	4.70	5.60	4.50	4.30	.....
26	10.00	7.50	5.20	5.20	6.15	4.60	5.45	4.50	4.30	.....
27	9.85	7.80	5.20	5.10	7.20	4.70	5.20	4.50	4.20	4.30
28	9.30	7.90	5.30	5.10	7.70	4.50	5.05	4.50	4.15	.....
29	8.70	8.05	5.10	5.00	7.70	4.50	4.90	4.50	(b)	.....
30	8.40	8.20	5.10	5.00	7.70	4.50	4.80	4.50	.....	.....
31	8.25	.....	5.10	.....	7.60	4.50	.....	4.50	.....	.....

[a] Frozen January 1 to March 24. [b] Readings November 29 to December 31 through ice.

Rating table for East Branch of Penobscot River at Grindstone, Me., from October 23, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.7	190	5.0	593	6.3	1,895	7.6	4,205
3.8	202	5.1	660	6.4	2,040	7.7	4,415
3.9	216	5.2	735	6.5	2,190	7.8	4,625
4.0	233	5.3	815	6.6	2,350	7.9	4,840
4.1	252	5.4	900	6.7	2,510	8.0	5,060
4.2	273	5.5	990	6.8	2,675	8.1	5,280
4.3	296	5.6	1,085	6.9	2,845	8.2	5,510
4.4	323	5.7	1,185	7.0	3,020	8.3	5,740
4.5	356	5.8	1,285	7.1	3,200	8.4	5,970
4.6	393	5.9	1,395	7.2	3,390	8.5	6,200
4.7	434	6.0	1,505	7.3	3,590		
4.8	480	6.1	1,625	7.4	3,790		
4.9	534	6.2	1,755	7.5	3,995		

Tangent at 8.10 feet gage height. Differences above this point, 230 per tenth. Table well determined between 5.15 and 8.10 feet gage heights.

Estimated monthly discharge of East Branch of Penobscot River at Grindstone, Me., for 1902 and 1903.

[Drainage area, 1,130 square miles.[a]]

Month.	Discharge in second-feet.			Run-off.	
	Minimum.	Maximum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
October 23–31	.....	.....	1,540	1.36	0.46
November	1,690	990	1,165	1.03	1.15
December 1–13[b]	.....	.....	836	.74	.36
1903.					
March 25–31[b]	9,650	5,625	7,843	6.94	1.81
April	5,970	2,845	4,606	4.08	4.55
May	5,970	660	3,154	2.79	3.22
June	2,675	534	1,001	.89	.99
July	4,840	593	2,677	2.37	2.73
August	4,205	356	1,680	1.49	1.72
September	1,755	296	618	.55	.61
October	534	252	346	.31	.36
November 1–28	.....	.....	487	.43	.45

[a] Drainage area includes Chamberlain Lake drainage basin of 270 square miles. See description of St. John drainage basin.
[b] River frozen December 14, 1902, to March 24, 1903, and November 29 to December 31, 1903.

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, ME.

This station was established August 26, 1902, by F. E. Pressey. It is located at the Maine Central Railroad bridge in the village of Mattawamkeag. The area of the drainage basin at this point is 1,510 square miles. The initial point for soundings is on the south abutment at the lower end of the inclined end post of the downstream truss. The gage is of the standard chain type; length of chain, 33.40 feet. The scale board is nailed to the guard timber of the lower side of the bridge. It is referred to bench marks, as follows: (1) Southwest corner of bridge seat of north abutment; elevation, 26.87 feet. (2) Copper bolt in bowlder north of bridge and west of railroad; elevation, 19.01 feet. (3) Marked point on stringer near gage; elevation, 31.42 feet. All elevations are above gage datum. The channel both above and below this station is straight, and has a width of about 400 feet at ordinary stages, broken by two piers. The bed of the stream is rocky and permanent. The water is confined to the channel by the abutments of the bridge. The observed mean velocities at this station have been between 4.11 feet per second at gage height 9.15 feet and 0.90 of a foot per second at gage height 2.75 feet. Low-water measurements are made by wading at a point about 1 mile above the station, where the velocities are greater than at the bridge and the bed is gravelly. The bridge is slightly oblique to the thread of the stream.

Dams are maintained at the outlets of several of the lakes and ponds in this basin, and the stored water is used for driving logs. Probably 90 per cent of the land surface is in forest. The gage is read twice daily by W. T. Mincher.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Mattawamkeag River at Mattawamkeag, Me., in 1902 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
1902.[a]			
July 31	F. E. Pressey	4.40	1,172
August 27	do	4.70	1,598
September 16	do	5.00	1,676
November 8	do	5.89	3,048
1903.			
April 4	do	9.15	9,785
April 25	do	7.15	5,413
May 25	C. N. McCulloch	4.45	1,109
June 11	F. E. Pressey	4.02	742
August 8	do	3.87	558
September 11	N. C. Grover	3.39	340
October 14	do	2.75	121
October 23	F. E. Pressey	3.32	302
May 18	do	4.58	1,265

[a] Recomputed, using standard cross section determined in 1903.

Mean daily gage height, in feet, of Mattawamkeag River at Mattawamkeag, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	9.65	7.25	4.00	4.55	4.60	3.50	3.20	3.50	4.20
2	.....	9.35	7.00	3.95	4.50	4.45	3.40	3.20	3.50	4.10
3	.....	9.05	6.80	4.00	4.40	4.25	3.50	3.20	3.50	4.00
4	.....	9.15	6.70	3.95	4.40	4.00	3.50	3.20	3.50	3.90
5	.....	9.15	6.75	4.00	4.35	4.00	3.50	3.10	3.60	3.90
6	.....	9.00	6.65	4.00	4.20	4.00	3.50	2.90	3.70	4.00
7	.....	9.05	6.70	3.95	4.25	3.90	3.50	2.90	3.80	4.10
8	.....	9.05	6.85	4.00	4.40	3.90	3.40	3.00	3.80	4.10
9	(a)	9.45	6.70	3.90	4.40	3.80	3.40	3.00	3.90	4.10
10	10.05	9.90	6.40	4.10	4.25	3.70	3.50	2.80	4.05	4.10
11	11.90	10.10	6.35	4.10	3.95	3.60	3.50	2.80	4.10	4.10
12	12.70	10.00	6.20	4.30	3.80	3.80	3.40	2.80	4.15	4.10
13	12.90	9.85	6.15	4.60	3.65	3.80	3.30	2.70	4.35	4.20
14	10.30	9.60	6.40	4.55	3.60	3.80	3.30	2.70	4.60	4.60
15	10.50	9.45	6.15	4.55	3.75	3.80	3.20	2.70	4.80	4.70
16	10.25	9.10	5.80	4.55	3.95	3.80	3.20	2.70	4.80	4.80
17	10.20	9.00	5.30	4.60	4.35	3.70	3.40	2.70	4.70	4.90
18	10.15	8.85	5.20	4.45	4.70	3.60	3.50	2.80	4.70	(b)
19	10.00	8.60	5.10	4.30	4.70	3.80	3.50	3.00	4.70	.....
20	10.00	8.45	5.15	4.20	4.65	3.90	3.50	3.25	4.70	4.90
21	10.00	7.90	5.20	4.20	4.50	4.00	3.40	3.40	4.40	.....
22	10.00	7.40	5.20	4.15	4.50	4.00	3.30	3.40	4.40	.....
23	10.20	7.20	5.20	4.00	4.50	4.10	3.20	3.40	4.30	.....
24	10.60	7.10	5.20	4.00	4.60	4.10	3.30	3.40	4.20	.....
25	11.25	7.15	4.95	4.00	4.60	4.10	3.30	3.40	4.50	.....
26	11.25	7.25	4.90	4.00	4.60	4.00	3.30	3.40	4.60	.....
27	11.15	7.50	4.95	4.00	4.45	3.90	3.30	3.50	4.50	5.50
28	11.00	7.65	4.85	4.00	4.25	3.80	3.30	3.70	4.40	.....
29	10.80	7.45	4.75	4.00	4.20	3.70	3.30	3.60	4.40	.....
30	10.30	7.30	4.55	4.35	4.10	3.70	3.20	3.50	4.30	.....
31	9.95	.....	4.25	.....	4.35	3.60	.....	3.40	.....	.....

a Frozen January 1 to March 9. b Readings December 18 to 31 through ice.

Rating table for Mattawamkeag River at Mattawamkeag, Me., from August 26, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.7	110	3.9	630	5.2	2,070	7.6	6,340
2.8	133	4.0	710	5.4	2,350	7.8	6,760
2.9	160	4.1	790	5.6	2,650	8.0	7,200
3.0	191	4.2	880	5.8	2,970	8.2	7,640
3.1	226	4.3	975	6.0	3,305	8.4	8,080
3.2	262	4.4	1,075	6.2	3,645	8.6	8,520
3.3	300	4.5	1,175	6.4	3,995	8.8	8,980
3.4	340	4.6	1,285	6.6	4,355	9.0	9,440
3.5	382	4.7	1,400	6.8	4,725	9.2	9,900
3.6	432	4.8	1,520	7.0	5,110		
3.7	490	4.9	1,650	7.2	5,510		
3.8	556	5.0	1,790	7.4	5,920		

Tangent at 9.2 feet gage height. Differences above this point 240 per tenth.

Mean daily discharge, in second-feet, of Mattawamkeag River at Mattawamkeag, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	10,980	5,610	710	1,230	1,285	382	262	382	880
2	.....	10,260	5,110	670	1,175	1,125	340	262	382	790
3	.....	9,555	4,725	710	1,075	925	382	262	382	710
4	.....	9,785	4,585	670	1,075	710	382	262	382	630
5	.....	9,785	4,630	710	1,025	710	382	226	432	630
6	.....	9,440	4,445	710	880	710	382	160	490	710
7	.....	9,555	4,585	670	925	630	382	160	556	790
8	.....	9,555	4,820	710	1,075	630	340	191	556	790
9	.....	10,500	4,585	630	1,075	556	340	191	630	790
10	11,940	11,580	3,995	790	925	490	382	133	750	790
11	16,380	12,060	3,905	790	670	432	382	133	790	790
12	18,300	11,820	3,645	975	556	556	340	133	835	790
13	18,780	11,460	3,560	1,285	460	556	300	110	1,025	880
14	12,540	10,860	3,995	1,230	432	556	300	110	1,285	1,285
15	13,020	10,500	3,560	1,230	522	556	262	110	1,520	1,400
16	12,420	9,670	2,970	1,230	670	556	262	110	1,520	1,520
17	12,300	9,440	2,210	1,285	1,025	490	340	110	1,400	1,650
18	12,180	9,095	2,070	1,125	1,400	432	382	133	1,400	.....
19	11,820	8,520	1,980	975	1,400	556	382	191	1,400	.....
20	11,820	8,190	2,000	880	1,340	630	382	281	1,400	.....
21	11,820	6,980	2,070	880	1,175	710	340	340	1,075	.....
22	11,820	5,920	2,070	835	1,175	710	300	340	1,075	.....
23	13,300	5,510	2,070	710	1,175	790	262	340	975	.....
24	13,260	5,310	2,070	710	1,285	790	300	340	880	.....
25	14,820	5,410	1,720	710	1,285	790	300	340	1,175	.....
26	14,820	5,610	1,650	710	1,285	710	300	340	1,285	.....
27	14,580	6,130	1,720	710	1,125	630	300	382	1,175	.....
28	14,220	6,235	1,585	710	925	556	300	490	1,075	.....
29	13,740	6,025	1,460	710	880	490	300	432	1,075	.....
30	12,540	5,710	1,230	1,025	790	490	262	382	975	.....
31	11,700	.....	925	.....	1,025	432	.....	340	.....	.....

Estimated monthly discharge of Mattawamkeag River at Mattawamkeag, Me., for 1902 and 1903.

[Drainage area, 1,510 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
August 26–31 [a]	.....	.....	1,191	0.79	0.18
September	1,790	750	1,218	.81	.90
October	7,200	1,075	2,090	1.38	1.59
November	6,870	2,070	2,999	1.99	2.22
December 1–12 and 17–19 [a]	.....	.....	3,855	2.55	1.42
1903.					
March 10–31 [a]	.....	.....	13,551	8.97	7.34
April	12,060	5,310	8,715	5.77	6.44
May	5,610	925	3,076	2.04	2.35
June	1,285	630	856	.57	.64
July	1,400	432	1,002	.66	.76
August	1,285	432	651	.43	.50
September	382	262	333	.22	.25
October	490	119	245	.16	.18
November	1,520	382	743	.49	.55
December 1–17 [a]	.....	.....	931	.62	.39

[a] River frozen for days not included.

PISCATAQUIS RIVER NEAR FOXCROFT, ME.

This station was established August 17, 1902, by F. E. Pressey. It is located at Low's Bridge, about halfway between Guilford and Foxcroft. The area of the drainage basin at this point is 280 square miles. The initial point for soundings is on the left bank at the top of the face of the left abutment. The gage is a painted staff spiked to the left abutment. It is referred to bench marks as follows: (1) Top of second course from top of left abutment; elevation, 17.80 feet. (2) Copper bolt in ledge, 150 feet north of highway and 75 feet west of river; elevation, 20.97 feet. (3) Marked point on bottom chord of upstream truss of bridge, 30 feet from initial point; elevation, 21.80 feet. All elevations are above gage datum. The channel both above and below the station is straight and has a width of about 90 feet at ordinary stages. The banks are high and rocky; the bed is rough and rocky, but permanent.

Observed mean velocities at the station have been between 3.63 feet per second at gage height 4.30 feet and 0.54 of a foot at gage height 2 feet. Low-water measurements are made by wading, either above or below the bridge, at points where the bed is fine gravel, and the velocity is greater than at the bridge. Water power is used at several manufacturing plants within a few miles above the station. As a result of the interruptions, due to the irregular use of water at the mills, the river fluctuates, at low stages, through nearly a foot on the gage within the day. The small amount of stored water in this basin is generally used for log driving. Slopes are steep. The river rises and falls rapidly. Probably 50 per cent of the basin is in forest. The gage is read twice daily by A. F. D. Harlow.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Piscataquis River near Foxcroft, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 6	F. E. Pressey	4.30	1,487
May 14	E. G. Hartford	2.80	370
Do	do	2.79	368
June 12	F. E. Pressey	2.47	169
Do	do	2.64	208
Do	do	2.48	160
September 16	N. C. Grover	2.19	112
October 3	do	1.52	22
October 31	F. E. Pressey	1.78	31
Do	do	1.94	79
Do	do	1.78	37
November 24	do	2.50	181

Mean daily gage height, in feet, of Piscataquis River near Foxcroft, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 3.90	5.05	3.25	2.35	2.40	3.65	2.10	1.50	1.75	1.75
2	4.05	4.85	3.10	2.30	2.40	2.70	2.05	1.50	1.75	1.75
3	4.25	4.75	2.95	2.25	2.40	2.55	2.05	1.50	1.75	1.65
4	4.25	5.00	2.90	2.20	2.40	2.55	1.85	1.50	1.75	1.65
5	4.50	5.35	2.90	2.20	2.25	2.45	2.35	1.75	1.75	1.75
6	4.05	5.05	2.85	2.05	2.35	2.45	2.00	1.80	1.75	1.65
7	3.90	4.30	2.90	2.00	2.25	2.25	1.90	1.75	1.75	1.75
8	3.75	4.60	2.85	2.00	2.25	2.25	1.70	1.75	1.70	1.75
9	4.50	5.80	2.70	2.50	2.35	2.10	2.00	1.75	1.95	1.75
10	5.40	5.70	2.80	2.15	2.45	2.35	1.90	1.75	2.00	1.75
11	8.45	5.60	2.70	2.15	2.55	2.55	1.70	1.75	1.90	1.70
12	10.90	4.85	2.60	2.25	2.55	2.85	1.70	1.75	2.10	1.70
13	9.60	4.55	2.55	4.70	2.45	2.85	1.50	1.75	2.30	1.85
14	8.95	4.45	2.55	6.95	2.40	2.90	1.60	1.70	2.40	2.05
15	7.80	4.20	2.55	4.80	2.45	2.60	1.70	1.60	2.20	2.15
16	7.05	4.40	2.55	4.25	2.45	2.50	2.00	1.50	2.40	2.35
17	5.80	4.80	2.55	4.25	2.50	2.30	1.90	1.50	2.10	2.05
18	6.10	4.55	2.55	4.05	2.60	2.30	1.70	1.55	2.20	2.00
19	5.50	4.45	2.55	4.00	2.30	2.25	1.90	2.50	2.00	2.00
20	6.55	4.40	2.60	3.70	2.40	2.30	1.60	2.40	1.80	2.15
21	6.75	4.45	2.75	3.80	2.35	2.85	1.80	2.30	1.95	3.75
22	6.55	4.10	3.15	2.95	2.35	3.00	1.80	2.30	1.65	4.40
23	6.80	4.05	3.15	2.75	2.60	2.75	1.75	2.05	1.80	4.10
24	7.25	3.80	2.95	2.75	3.05	2.60	1.70	2.10	2.10	3.85
25	7.05	3.75	2.35	2.70	2.90	2.40	1.60	1.50	2.00	3.35
26	6.15	3.40	2.45	2.70	3.15	2.25	1.50	1.70	1.90	3.30
27	5.80	3.30	2.35	2.55	3.15	2.25	1.50	1.75	1.85	2.90
28	5.30	3.40	2.30	2.50	2.50	2.25	1.50	1.75	1.85	3.20
29	5.00	3.30	2.30	2.40	2.45	2.30	1.50	1.80	1.85	3.20
30	4.65	3.30	2.00	2.40	2.65	1.90	1.50	1.80	1.75	3.10
31	4.40	.....	2.30	.....	3.80	2.20	.....	1.80	.....	3.05

[a] Frozen January 1 to February 28.

Rating table for Piscataquis River near Foxcroft, Me., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	21	2.4	148	3.3	680	4.2	1,400
1.6	24	2.5	180	3.4	760	4.3	1,480
1.7	30	2.6	221	3.5	840	4.4	1,560
1.8	38	2.7	270	3.6	920	4.5	1,640
1.9	49	2.8	323	3.7	1,000	4.6	1,720
2.0	64	2.9	381	3.8	1,080	4.8	1,880
2.1	81	3.0	447	3.9	1,160	5.0	2,040
2.2	100	3.1	521	4.0	1,240	5.2	2,200
2.3	123	3.2	600	4.1	1,320		

Tangent at 5.0 feet gage height. Differences above this point 80 per tenth.

Estimated monthly discharge of Piscataquis River near Foxcroft, Me., for 1903.

[Drainage area, 280 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March	6,760	1,040	2,813	10.05	11.59
April	2,680	680	1,601	5.72	6.38
May	640	64	284	1.01	1.16
June	3,600	64	607	2.17	2.42
July	1,080	111	233	.83	.96
August	960	49	214	.76	.88
September	135	21	43	.15	.17
October	180	21	47	.17	.20
November	148	27	60	.21	.23
December	1,560	27	324	1.16	1.34

KENNEBEC RIVER DRAINAGE BASIN.

Kennebec River is one of the best streams in the United States for the development of water power. Its basin, which lies wholly within the State of Maine, between those of the Androscoggin and the Penobscot, is 150 miles in length and from 50 to 80 miles in width in the main portion, embracing a total area of 6,110 square miles. Of this area 1,330 square miles are tributary to Moosehead Lake, in which the river has its source. The upper tributaries, however, rise in the hilly, forested areas lying to the east and west of that lake. Of these, Moose River is the most important. The northern part of the drainage basin is broken by offsets from the White Mountains. Nearly the whole of the upper portion is forest covered and in its original wild state.

Below the outlet of Moosehead Lake the hills close in upon the river, forming a narrow, rocky chasm, with steep and precipitous sides. From Moosehead Lake to The Forks the river is a torrent, the total fall in the 23 miles being 500 feet. Dead River is tributary to the Kennebec at The Forks. Below this junction the river flows with a lesser slope in a narrow, winding bed about 20 miles to Bingham; thence through a broader valley in which are located many farms. There are between Bingham and tide water a number of large falls at which water power has been developed.

The prevailing rock in the northern part of the basin is slate, with a belt of sandstone to the west and a district of granite to the east of Moosehead. South of Bingham mica-schists run into the clay slate

in spots and elsewhere into gneiss, but (except where broken by intrusions of granite, as at Hallowell and Augusta) slate prevails as far as Gardiner. Below the latter city gneiss predominates, with stretches of mica-schists on the east bank. The surface materials are finely pulverized. Water-retaining sands and gravels are more abundant in the northern part, succeeded by a greater proportion of loam and clay to the south.

The areas of the drainage basins of the river and its principal tributaries are given in the following table:

Drainage areas of Kennebec River and principal tributaries.

River.	Locality.	Drainage area.
		Square miles.
Kennebec	Outlet of Moosehead Lake	1,330
Do	The Forks	1,670
Do	Immediately below mouth of Dead River	2,540
Do	Caratunk Falls, Solon	2,790
Do	North Anson, above mouth of Carrabassett River.	2,880
Do	Madison	3,310
Do	Norridgewock	4,020
Do	Fairfield	4,370
Do	Waterville, above mouth of Sebasticook River.	4,380
Do	Waterville, below mouth of Sebasticook River.	5,310
Do	Augusta	5,710
Do	Head of Merrymeeting Bay	6,110
Moose	Mouth	680
Roach	Roach River	85
Dead	Mouth, The Forks	870
Carrabassett	North Anson, above Embden Brook	340
Do	Mouth	395
Sandy	Farmington	350
Do	Mouth	670
Sebasticook	do	930
Messalonskee	do	220
Cobbosseecontee	do	240

The United States Geological Survey now maintains gaging stations at the following places in the Kennebec drainage: On the Kennebec at The Forks and at North Anson, on Carrabassett River at North Anson, on Dead River at The Forks, on Moose River at Rockwood, and on Roach River at Roach River.

KENNEBEC RIVER AT THE FORKS, ME.

This station was established by N. C. Grover September 28, 1901, at the wooden highway bridge across Kennebec River at The Forks, above the mouth of Dead River. The drainage area at the station is 1,670 square miles. Of this area 1,330 square miles are tributary to Moosehead Lake, while the remaining 340 square miles are drained into the Kennebec by small streams with steep slopes and no storage. Practically all land surfaces above this point are in forest. There are two gages: One, a vertical rod, is attached to the timber retaining-wall on the left bank about 75 feet above the bridge; the other is of the standard chain type, and is attached to the bridge floor; length of chain 17.18 feet. The datum of the two gages is the same and is referred to two bench marks: (1) The top of a bolt on the east abutment, north side of bridge; elevation, 12.85 feet above gage datum. (2) Marked point on the floor of the bridge near the east end of the gage box; elevation, 15.42 feet above gage datum. The initial point for soundings is on the left bank, marked by a rod across the bridge, just above the abutment and below the bridge floor. The channel is straight above the station for about 200 feet, and below for a distance of 500 feet; is unbroken by piers, and is about 125 feet wide at ordinary stages of the river. The current is swift; observed mean velocities ranged from 7.67 feet per second at gage height 5.60 to 0.86 of a foot per second at gage height 0.90. The banks are high and rocky and the bed is rocky and permanent. The gage is read twice daily by William W. Young.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Kennebec River at The Forks, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 18	F. E. Pressey	3.95	4,176
November 4	do	1.26	757
Do	do	1.26	759

Mean daily gage height, in feet, of Kennebec River at The Forks, Me., for 1903.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.90	2.55	3.45	4.25	4.25	3.15	2.50	2.40	1.30	1.00
2	(a)	3.80	2.45	3.50	4.15	3.90	3.50	2.55	2.35	1.30	1.00
3	3.00	.....	4.45	2.75	3.95	3.80	3.05	2.65	2.30	1.30	1.00
4	3.00	.....	6.15	3.10	3.45	3.65	3.05	2.70	2.25	1.30	1.00
5	3.00	3.70	6.45	2.90	3.65	3.70	2.95	2.65	2.20	1.30	1.00
6	3.00	3.65	7.05	3.30	3.60	4.40	3.00	2.75	2.20	1.30	1.00
7	3.00	3.60	6.80	3.10	3.40	3.55	3.05	3.00	2.20	1.30	1.00
8	3.05	3.55	6.80	3.65	3.50	3.90	2.90	2.90	2.10	1.30	1.00
9	3.30	3.60	6.80	4.30	3.60	3.90	2.90	2.90	1.65	1.30	1.00
10	3.30	3.65	6.90	3.55	3.65	3.90	2.90	2.75	1.50	1.30	1.00
11	3.35	3.90	6.90	3.55	3.60	3.85	3.00	2.65	1.50	1.20	1.05
12	3.45	2.75	5.95	3.90	3.70	3.70	2.95	2.60	1.65	1.20	1.00
13	3.35	2.75	3.20	3.85	2.55	3.85	2.85	2.60	1.60	1.20	1.05
14	3.30	3.00	3.65	4.15	2.70	3.85	2.80	2.60	1.60	1.20	1.30
15	3.25	3.05	5.65	3.45	2.30	3.85	2.70	2.50	1.10	1.20	1.25
16	3.20	3.05	6.40	4.80	1.95	3.70	2.75	2.50	1.70	1.20	(b)
17	3.20	3.00	6.95	4.00	1.70	3.75	3.70	2.50	1.70	1.20	.....
18	3.20	2.90	7.05	4.00	1.60	3.95	2.85	2.40	1.90	1.20	.....
19	3.20	2.75	6.85	3.50	3.80	3.70	2.95	2.45	1.85	1.20	1.60
20	3.20	3.15	6.75	4.75	1.80	3.55	2.95	2.35	1.80	1.20	1.45
21	3.20	3.75	6.55	3.70	3.80	3.45	3.15	2.25	1.70	1.10	2.40
22	3.20	3.85	6.45	3.30	3.80	3.40	3.30	2.20	1.65	1.10	1.80
23	3.20	4.05	6.30	2.80	3.85	3.40	3.45	2.60	1.50	1.10	1.60
24	3.20	4.10	6.05	2.40	3.90	3.40	2.90	2.60	1.50	1.10	1.60
25	3.20	4.45	5.60	3.00	4.65	3.40	2.85	2.55	1.55	1.00	1.70
26	3.25	4.05	3.10	3.00	4.50	3.40	2.60	2.45	1.50	1.00	1.60
27	4.20	3.70	3.00	3.45	4.50	3.45	2.60	2.40	1.50	1.00	1.50
28	4.20	3.35	3.70	3.75	5.00	3.45	2.50	2.45	1.50	1.00	1.50
29	.....	3.05	3.85	3.50	4.70	3.30	2.60	2.40	1.50	1.00	1.40
30	.....	2.70	3.50	2.90	4.55	3.25	2.55	2.40	1.30	1.00	2.00
31	.....	2.75	.....	3.00	.....	3.15	2.50	.....	1.30	.....	2.00

a Frozen January 1 to February 2.

b Readings December 16 to 31 through ice.

Rating table for Kennebec River at The Forks, Me., from Janury 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	560	2.2	1,525	3.3	2,790	4.4	5,020
1.1	640	2.3	1,610	3.4	2,950	4.5	5,260
1.2	720	2.4	1,700	3.5	3,130	4.6	5,510
1.3	800	2.5	1,800	3.6	3,310	4.7	5,770
1.4	880	2.6	1,900	3.7	3,500	4.8	6,040
1.5	960	2.7	2,000	3.8	3,700	4.9	6,320
1.6	1,040	2.8	2,105	3.9	3,910	5.0	6,620
1.7	1,120	2.9	2,220	4.0	4,120	5.1	6,940
1.8	1,200	3.0	2,350	4.1	4,330	5.2	7,270
1.9	1,285	3.1	2,490	4.2	4,560	5.3	7,600
2.0	1,365	3.2	2,635	4.3	4,790	5.4	8,000
2.1	1,445	.....	.....	.....	.....	.....	.....

Tangent at 5.4 feet gage height. Differences above this point 400 per tenth.

Estimated monthly discharge of Kennebec River at The Forks, Me., for 1903.

[Drainage area, 1,670 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
February 3–28 [a]	4,560	2,350	2,778	1.66	1.60
March	5,140	2,000	3,146	1.88	2.17
April	14,600	1,750	9,322	5.58	6.22
May	6,040	1,700	3,242	1.94	2.24
June	6,620	1,040	3,513	2.10	2.34
July	5,020	2,560	3,473	2.08	2.40
August	3,500	1,800	2,301	1.38	1.59
September	2,350	1,525	1,864	1.12	1.25
October	1,700	640	1,157	.69	.80
November	800	560	704	.42	.47
December 1–15 [b]	800	560	595	.36	.20

[a] Frozen January 1 to February 2. [b] Frozen December 16 to 31.

KENNEBEC RIVER AT NORTH ANSON, ME.

This station was established on October 18, 1901, by N. C. Grover. It is located 1½ miles east of North Anson, above the mouth of Carrabassett River. The drainage area at this point is 2,880 square miles.

Measurements are made from the wooden highway bridge across the Kennebec, known locally as Patterson bridge. There are three gages: One is a vertical rod fastened to the bridge pier; another, for high-water observations, is a vertical rod attached to the right abutment; the third is a low-water gage of the standard chain type, and is attached to the wooden truss on the upstream side of the bridge; length of chain, 30.40 feet. The datum of the three gages is the same and is referred to four bench marks: (1) Top of pier back of the gage; elevation, 22.50 feet. (2) Top of the southeast corner of the twelfth stone from the top of west abutment; elevation, 9.55 feet. (3) Copper bolt in bowlder on right bank about 100 feet above the bridge; elevation, 10.66 feet. (4) Marked point on the bottom chord of the bridge near the chain gage; elevation, 25.15 feet. The initial point for soundings is on the left bank at the outside of the end post of the center truss of the bridge. The channel is straight above the station for 500 feet and below for 1,000 feet and has a width of about 350 feet, broken by one pier. The current is moderately rapid, except near the left bank; observed mean velocities at the station have ranged from 3.65 feet per second at gage height 6.80 feet to 1.40 feet per second at gage height 2.85. Low-water measurements are made from a boat about 1,000 feet below the station at a section where there is a better distribution of current. The right bank is high and rocky, while the left bank is comparatively low and subject to overflow at the time of highest water. The bed of the stream is rocky, with sand over a portion of the section, and is permanent. The gage is read twice daily by Mrs. C. S. Benjamin, the toll collector at the bridge.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Kennebec River at North Anson, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 28	F. E. Pressey	6.50	11,438
May 27	do	3.25	3,134
June 15	do	6.80	11,124
June 16	do	4.90	6,741
Do	do	4.38	5,575
July 17	do	3.25	2,965
August 15	do	3.78	3,988
September 24	N. C. Grover	2.85	2,498
November 6	F. E. Pressey	2.00	1,205

Mean daily gage height, in feet, of Kennebec River at North Anson, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.85	5.80	3.90	4.55	4.25	3.20	2.90	1.55	2.90
2	.....	4.90	5.55	3.50	3.40	3.90	3.10	3.05	1.90	(b)
3	.....	5.25	4.80	3.10	4.20	3.85	3.05	3.05	1.85	.....
4	.....	6.20	4.90	3.60	4.00	3.65	3.05	2.95	1.70	.....
5	.....	8.20	5.20	3.50	3.85	3.75	3.05	3.05	2.00	.....
6	.....	8.05	6.35	3.45	3.80	3.85	3.00	2.95	2.00	.....
7	.....	7.80	5.70	3.25	3.75	3.65	3.35	3.05	2.10	.....
8	.....	7.55	6.20	2.95	3.40	3.50	3.30	3.10	2.25	2.30
9	.....	7.70	6.30	3.10	3.25	3.60	3.10	3.10	2.45	.....
10	.....	8.35	5.00	3.95	3.60	3.60	3.10	2.95	2.30	.....
11	.....	8.05	5.65	4.25	3.65	3.45	3.15	2.35	2.25	.....
12	.....	7.95	6.00	4.25	3.65	3.75	3.20	2.40	2.05	.....
13	.....	6.25	5.45	8.55	3.55	3.70	3.10	2.55	2.25	.....
14	.....	6.40	5.10	8.55	3.45	3.50	2.95	2.45	2.10	.....
15	.....	6.60	5.25	6.50	3.20	3.50	3.05	2.25	2.05	.....
16	(a)	7.75	4.55	4.65	3.55	3.00	3.15	1.95	2.15	2.90
17	13.00	7.65	5.55	4.00	3.50	3.40	3.10	2.30	2.00	.....
18	12.50	7.30	4.95	3.55	3.25	3.00	3.05	2.35	1.95	.....
19	13.25	6.95	4.70	4.50	3.95	3.20	3.00	2.50	2.05	2.90
20	14.50	7.10	4.40	4.90	3.35	3.05	2.90	2.95	2.05	.....
21	14.95	6.70	5.00	4.65	3.25	3.75	3.05	2.95	2.00	.....
22	13.00	6.70	4.65	4.45	3.60	4.15	3.15	2.90	1.95	.....
23	12.50	7.00	5.20	4.30	3.95	4.25	3.10	2.40	2.05	.....
24	12.00	6.70	4.35	3.95	4.40	3.70	3.00	2.15	1.95	.....
25	11.00	6.15	4.60	4.35	4.30	3.25	3.25	1.70	1.90	.....
26	10.00	5.60	4.45	4.50	4.30	3.35	3.25	2.15	2.70	3.50
27	9.05	4.40	5.25	4.25	4.20	3.35	3.20	2.40	2.85	.....
28	7.25	4.30	4.95	4.25	3.10	3.30	3.20	2.30	2.95	.....
29	5.75	5.10	4.05	4.35	3.40	3.30	2.95	2.20	2.95	.....
30	5.10	4.95	3.70	4.15	3.80	3.15	2.95	1.95	2.95	.....
31	4.65	.....	4.00	.....	4.40	3.20	.....	1.90	.....	.....

a Frozen January 1 to March 16. b Readings December 2 to 31 through ice.

Rating table for Kennebec River at North Anson, Me., from October 18, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.4	680	2.4	1,700	3.4	3,330	4.8	6,540
1.5	760	2.5	1,840	3.5	3,520	5.0	7,040
1.6	840	2.6	1,990	3.6	3,720	5.2	7,540
1.7	930	2.7	2,140	3.7	3,925	5.4	8,040
1.8	1,020	2.8	2,290	3.8	4,140	5.6	8,540
1.9	1,110	2.9	2,450	3.9	4,360	5.8	9,060
2.0	1,205	3.0	2,615	4.0	4,590	6.0	9,580
2.1	1,310	3.1	2,785	4.2	5,060	6.2	10,100
2.2	1,430	3.2	2,960	4.4	5,540	6.4	10,640
2.3	1,560	3.3	3,140	4.6	6,040	6.6	11,180

Tangent at 6.2 feet gage height. Differences above this point, 270 per tenth.

Estimated monthly discharge of Kennebec River at North Anson, Me., for 1902 and 1903.

[Drainage area, 2,880 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
March 23–31[a]	.....	.....	16,392	5.69	1.90
April	27,515	9,710	13,561	4.71	5.26
May	23,870	7,415	12,892	4.48	5.17
June	20,090	7,540	12,031	4.18	4.66
July	9,840	5,180	7,403	2.57	2.96
August	7,790	1,915	4,186	1.45	1.67
September	5,180	2,615	3,494	1.21	1.35
October	9,450	2,065	3,648	1.27	1.46
November	7,290	2,530	3,622	1.26	1.41
December 1–5	.....	.....	3,312	1.15	.21
1903.					
March 17–31[b]	.....	.....	21,920	7.61	4.25
April	15,905	5,300	11,273	3.92	4.37
May	10,505	3,925	7,267	2.52	2.91
June	16,445	2,530	5,627	1.95	2.18
July	5,915	2,785	4,040	1.40	1.61
August	5,180	2,615	3,646	1.27	1.46
September	3,235	2,450	2,791	.97	1.08
October	2,785	930	1,966	.68	.78
November	2,530	800	1,449	.50	.56

[a] Frozen December 6, 1902, to March 16, 1902. [b] Frozen December 2 to 31, 1903.

KENNEBEC RIVER AT WATERVILLE, ME.

The only long-continued observations of the flow of the river are those which have been made at Waterville by the Hollingsworth & Whitney Company, which kindly furnishes the results for publication. The works of that company are above the mouth of Sebasticook River. The tributary drainage area of the Kennebec at that point is about 4,380 square miles. Observations are made at 12 o'clock noon of each day, that hour having been chosen, after investigation, as a time when the flow is least affected by storage at dams upstream, and as giving most nearly the average for the day.

When the flow of the river is less than 3,500 second-feet the whole amount is diverted through the water wheels of the mill, of which there are 48. Water in excess of the above amount is wasted over the dam. All of the wheels have been tested at Holyoke under practically the same head as used at Waterville. Discharge curves for the wheels, and for overflow of the dam, both with and without flashboards, were constructed several years ago by Mr. Sumner Hollingsworth. Esti-

mates of daily flow are made by means of these diagrams. The leakage through the crib dam has never been measured, but 100 second-feet are added arbitrarily to cover this item.

Mean daily discharge, in second-feet, of Kennebec River at Waterville, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6,577	4,129	6,706	15,606	9,173	4,593	5,636	5,608	3,349	2,573	158	1,269
2	4,811	4,486	8,468	16,465	12,725	4,282	5,813	3,777	3,299	2,271	1,272	1,270
3	4,046	4,088	8,320	13,543	7,250	4,761	5,215	5,065	3,002	2,278	2,141	1,253
4	2,551	4,231	7,646	16,153	8,308	4,758	4,640	4,888	3,124	1,002	1,480	1,849
5	4,347	4,003	7,107	23,548	6,610	4,351	2,773	4,530	1,995	1,996	1,773	1,208
6	4,361	4,050	6,480	21,937	6,946	4,312	5,338	4,337	527	2,110	1,527	100
7	4,012	3,971	6,069	21,610	7,895	2,397	5,088	4,066	2,920	2,524	1,460	1,260
8	3,988	3,925	6,640	21,752	7,546	4,345	5,134	3,999	3,174	2,309	119	335
9	3,992	4,004	8,115	23,374	9,507	4,354	4,678	1,120	3,476	2,590	1,467	1,351
10	3,907	3,741	13,273	22,595	8,024	4,547	4,923	4,358	3,106	2,158	2,293	1,237
11	2,061	3,985	18,755	23,662	8,685	4,918	4,831	4,044	3,086	100	1,957	1,238
12	3,684	4,088	31,283	21,245	8,546	4,337	2,547	3,755	2,814	2,029	1,965	1,238
13	4,020	4,408	27,438	18,734	8,733	6,466	5,358	4,268	712	2,021	1,547	100
14	3,443	4,356	24,487	15,036	7,355	30,050	5,123	4,887	3,420	2,018	1,552	915
15	3,627	3,841	24,518	16,390	8,306	17,999	4,809	4,529	2,901	143	960	1,226
16	3,764	2,003	21,560	17,298	8,313	10,219	4,758	712	2,915	1,464	1,483	925
17	4,032	4,042	18,188	19,328	5,705	5,286	5,587	4,885	3,245	1,141	1,957	200
18	3,336	4,025	17,496	17,921	8,129	5,373	4,849	3,947	3,697	100	2,283	893
19	4,070	4,028	17,645	16,768	7,940	5,172	2,445	3,444	3,176	1,522	2,845	207
20	3,739	4,013	35,732	16,175	7,962	5,079	4,978	3,446	358	3,126	2,774	100
21	3,717	3,952	33,641	15,219	7,253	5,438	4,721	3,874	1,531	3,984	1,419	1,289
22	3,998	2,370	31,798	15,577	7,870	7,930	4,939	5,624	3,190	2,555	118	2,678
23	4,413	3,754	31,650	15,689	5,362	7,194	5,385	3,701	2,612	2,542	1,979	3,825
24	4,756	3,696	34,315	15,111	4,765	6,698	9,018	4,010	1,700	2,604	1,972	3,206
25	4,245	3,957	34,353	13,498	5,614	6,900	7,483	4,384	2,545	118	1,432	2,727
26	4,210	3,936	30,089	11,783	7,866	5,490	6,405	3,915	1,975	2,747	863	2,480
27	4,121	3,639	25,326	5,919	5,952	6,416	6,554	3,606	115	1,913	1,330	2,510
28	4,199	3,980	21,480	5,531	5,928	5,654	5,001	3,857	2,881	2,022	680	1,292
29	4,014	.....	19,344	8,221	5,162	5,864	5,056	3,340	2,285	1,524	115	1,755
30	4,028	.....	11,029	8,274	3,363	5,556	4,895	672	1,964	2,567	1,127	1,335
31	4,268	.....	12,314	.....	2,098	.....	8,052	3,482	.....	1,534	.....	1,808

MOOSE RIVER NEAR ROCKWOOD, ME.

This station was established September 7, 1902, by N. C. Grover. It is located 4 miles west of Kineo, Me., and 2 miles from the mouth of the river. The drainage basin is 680 square miles at this point. Water is stored by dams at the outlets of several of the lakes and ponds in the basin above, but all of such stored water is used for log driving. The stage of the river changes very slowly after the end of the log-driving season. Practically all of the land areas in this basin are in forest. Measurements are made from a car suspended from a steel cable, or by wading at low water. The initial point for soundings is on the right bank, 1 foot from a birch tree, to which the tag line and cable are attached. There are two gages: One is a painted post driven into the clay bed of the river and braced from several trees; the other is a standard chain gage attached to trees on the bank. The datum of the two gages is the same, and is referred to bench marks as

follows: (1) Copper bolt in bowlder 8 feet from corner of house of Peter Callaghan; elevation, 14.58 feet. (2) Highest point of large bowlder on right bank 150 feet below the cable; elevation, 5.75 feet. The channel is about 220 feet wide at ordinary stages and is straight, both above and below the station. The banks are high and rocky; the bed of the stream is rocky and permanent. The gage is read twice daily by Peter Callaghan.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Moose River near Rockwood, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 7	F. E. Pressey	2.73	498
Sept. 16	N. C. Grover	1.85	198
Nov. 21	F. E. Pressey	1.69	176

Mean daily gage height, in feet, of Moose River near Rockwood, Me., for 1903.

Day.	Jan.	Mar.	Apr.	May.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	.....	6.95	5.65	.....	2.95	2.20	1.50	1.50	1.60
2	2.80	.....	6.75	5.80	.....	3.00	2.15	1.50	1.50	1.60
3	2.80	.....	6.55	5.55	.....	3.00	2.10	1.50	1.50	1.60
4	2.80	.....	6.50	(b)	.....	3.00	2.10	1.50	1.50	1.60
5	2.80	.....	6.55	.....	.....	2.90	2.10	1.50	1.50	1.60
6	2.80	.....	6.60	.....	.....	2.90	2.10	1.50	1.60	1.60
7	2.80	.....	6.55	.....	2.70	2.85	2.05	1.50	1.60	1.60
8	2.80	.....	6.35	.....	2.70	2.80	2.00	1.50	1.60	1.60
9	2.80	.....	6.30	.....	2.70	2.70	2.00	1.50	1.60	1.60
10	2.70	.....	6.20	.....	2.70	2.70	1.95	1.50	1.60	1.65
11	(a)	.....	6.25	.....	2.70	2.60	1.90	1.50	1.65	1.70
12	.....	.....	6.25	.....	2.70	2.70	1.90	1.50	1.70	1.70
13	.....	.....	6.25	.....	2.60	2.60	1.90	1.50	1.70	1.70
14	.....	.....	6.20	.....	2.60	2.60	1.90	1.50	1.70	1.70
15	.....	.....	6.20	.....	2.60	2.55	1.90	1.50	1.70	1.55
16	.....	.....	6.25	.....	2.60	2.50	1.80	1.50	1.70	1.30
17	.....	.....	6.20	.....	2.70	2.50	1.80	1.50	1.70	(a)
18	.....	.....	5.95	.....	2.70	2.50	1.80	1.50	1.80	.....
19	.....	.....	5.85	.....	2.70	2.55	1.80	1.50	1.80	.....
20	.....	.....	5.80	.....	2.70	2.75	1.75	1.50	1.80	.....
21	.....	5.70	5.70	.....	2.70	2.85	1.70	1.50	1.70	.....
22	.....	5.75	5.55	.....	2.65	2.85	1.70	1.50	1.70	.....
23	.....	6.10	5.50	.....	2.65	2.75	1.70	1.50	1.70	.....
24	.....	6.50	5.50	.....	2.70	2.70	1.70	1.50	1.70	.....
25	.....	6.90	5.60	.....	2.65	2.60	1.60	1.50	1.70	.....
26	.....	7.25	5.50	.....	2.60	2.50	1.60	1.60	1.70	.....
27	.....	7.45	5.50	.....	2.55	2.45	1.60	1,60	1.60	.....
28	.....	7.50	5.55	.....	2.50	2.35	1.60	1.60	1.60	.....
29	.....	7.40	5.50	.....	2.50	2.30	1.60	1.55	1.60	.....
30	.....	7.25	5.60	.....	2.55	2.20	1.55	1.50	1.60	.....
31	.....	7.15	.....	.....	2.70	2.20	.....	1.50	.....	.....

a Frozen January 11 to March 20 and December 17 to 31. b Low-water gage gone.

ROACH RIVER AT ROACH RIVER, ME.

This stream, which has a total drainage area of 120 square miles, enters Moosehead Lake from the east. Its basin is completely forested. Dams at the outlets of several ponds control the flow of the river. The gage is located about 100 feet downstream from the lowest of these dams, at which point the river is so completely under control that the stage does not vary perceptibly for weeks at a time. Impounded water is used for log driving.

This station was established November 10, 1901, by N. C. Grover. The drainage area at this point is 85 square miles. The gage is a vertical rod spiked to the timber retaining wall on the right bank of the stream. It is referred to a bench mark, which is a cross cut in the highest timber of the crib to which the gage is spiked; elevation, 9 feet. Meter measurements of flow are made by wading, or from a boat at a section about 2,000 feet downstream from the gage. The bed of the stream at this point is rocky and permanent. The channel is straight and about 60 feet wide. The gage is read twice daily by C. H. Sawyer.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Mean daily gage height, in feet, of Roach River at Roach River, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	2.20	2.20	5.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10
2	2.20	2.20	2.20	5.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10
3	2.20	2.20	2.20	2.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10
4	2.20	2.20	2.20	2.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10
5	2.20	2.20	2.20	2.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10
6	2.20	2.20	2.20	2.20	2.10	5.00	2.20	2.20	2.20	2.10	2.10	2.10
7	2.20	2.20	2.20	2.20	2.10	5.00	2.20	2.20	2.20	2.10	2.10	2.10
8	2.20	(a)	2.60	3.80	5.40	5.00	2.20	2.20	2.20	2.10	2.10	2.10
9	2.20	.....	3.00	3.80	5.40	5.00	2.20	2.20	2.20	2.10	2.10	2.10
10	2.20	.....	3.00	3.80	5.40	5.00	2.20	2.20	2.20	2.10	2.10	2.10
11	2.20	.....	3.00	3.80	5.40	5.00	2.20	2.20	2.40	2.10	2.10	2.10
12	2.20	.....	3.00	3.80	2.10	2.00	2.20	2.20	2.40	2.10	2.10	2.10
13	2.20	.....	3.20	4.00	2.10	2.00	2.20	2.20	2.40	2.10	2.10	2.10
14	2.20	.....	3.90	5.80	2.10	2.00	2.20	2.20	2.40	2.10	2.10	2.10
15	2.20	.....	3.90	5.60	2.10	2.00	2.20	2.20	2.40	2.10	2.10	2.10
16	2.20	.....	3.90	5.40	2.10	2.00	2.20	2.20	2.40	2.10	2.10	2.10
17	2.20	.....	3.90	2.20	5.40	2.00	2.20	2.20	2.30	2.10	2.10	2.10
18	2.20	.....	3.90	3.80	5.15	2.00	2.20	2.20	2.30	2.10	2.10	2.10
19	2.20	.....	3.90	3.80	5.00	2.00	2.20	2.20	2.30	2.10	2.10	2.10
20	2.20	.....	3.90	3.80	5.00	2.00	2.20	2.20	2.30	2.10	2.10	2.10
21	2.20	.....	3.90	2.20	5.00	2.00	2.20	2.20	2.30	2.10	2.10	2.10
22	2.20	.....	3.90	3.80	2.00	2.00	2.20	2.20	2.30	2.10	2.10	2.10
23	2.20	.....	2.20	2.15	2.00	2.00	2.20	2.20	2.30	2.10	2.10	2.10
24	2.20	.....	2.20	2.10	2.00	2.00	2.20	2.20	2.10	2.10	2.10	2.10
25	2.20	.....	2.20	2.10	2.00	5.00	2.20	2.20	2.10	2.10	2.10	2.10
26	2.20	.....	4.60	2.10	2.00	5.00	2.20	2.20	2.10	2.10	2.10	2.10
27	2.20	.....	4.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10	2.10
28	2.20	2.20	4.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10	2.10
29	2.20	.....	4.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10	2.10
30	2.20	.....	5.20	2.10	2.00	2.20	2.20	2.20	2.10	2.10	2.10	2.10
31	2.20	.....	5.20	.....	2.00	.....	2.20	2.20	.....	2.10	.....	2.10

a Frozen February 8 to February 27.

Rating table for Roach River at Roach River, Me., from November 10, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	20	3.1	370	4.2	832	5.3	1,294
2.1	31	3.2	412	4.3	874	5.4	1,336
2.2	48	3.3	454	4.4	916	5.5	1,378
2.3	67	3.4	496	4.5	958	5.6	1,420
2.4	90	3.5	538	4.6	1,000	5.7	1,462
2.5	118	3.6	580	4.7	1,042	5.8	1,504
2.6	156	3.7	622	4.8	1,084	5.9	1,546
2.7	200	3.8	664	4.9	1,126	6.0	1,588
2.8	244	3.9	706	5.0	1,168		
2.9	286	4.0	748	5.1	1,210		
3.0	328	4.1	790	5.2	1,252		

Estimated monthly discharge of Roach River at Roach River, Me., for 1903.

[Drainage area, 85 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	48	48	48	0.56	0.65
February 7–27 [a]	48	48	48	.56	.17
March	1,252	48	614	7.22	8.32
April	1,504	31	469	5.52	6.16
May	1,336	20	706	8.31	9.58
June	1,168	20	330	3.88	4.33
July	48	48	48	.56	.65
August	48	48	48	.56	.65
September	90	31	57	.67	.75
October	31	31	31	.36	.42
November	31	31	31	.36	.40
December	31	31	31	.36	.42

[a] February 7 to 27, ice.

DEAD RIVER AT THE FORKS, ME.

This tributary of the Kennebec has its headwaters in the mountains between Maine and Canada, and flows in a general easterly direction, entering the Kennebec at The Forks. Its basin contains 870 square miles and is 40 miles in extreme length by 30 miles in width, and is almost entirely covered with forests. Through a large portion of its length the river flows through swamps; in its lower course it has considerable fall. The only dams on the stream are owned by the log-driving companies, and the gates are kept open after the drives are out of the river.

This gaging station was established by N. C. Grover on September 29, 1901. It is located 1½ miles west of The Forks. The measurements are made from a car suspended from a steel cable. The gage is a vertical rod attached to a large bowlder on the left bank about 700 feet below the cable. It is referred to a bench mark, a copper bolt set in a bowlder 9.5 feet from the gage; elevation, 7.97 feet above zero of the gage. The channel is straight for 500 feet above and below the cable, and is about 225 feet wide at ordinary stages. The banks are rocky and are subject to overflow in extreme freshets. The bed is rocky and permanent. The current is rapid; the lowest observed mean velocity is 0.65 of a foot per second at gage height 0.69. The gage is read twice daily by Jeremiah Durgin, jr., a farmer at The Forks.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Dead River at The Forks, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 5	F. E. Pressey	0.90	399
June 6	do	.90	401
July 15	do	1.10	739
August 18	do	.89	452
November 4	do	.69	211
Do	do	.69	214

Mean daily gage height, in feet, of Dead River at The Forks, Me., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.00	1.35	0.90	0.60	0.70	1.00
2	.....	1.00	1.40	.80	.60	.70	1.10
3	(a)	1.00	1.40	.80	.60	.70	1.10
4	1.00	1.00	1.30	.70	.60	.70	1.20
5	1.00	.90	1.15	.70	.60	.80	1.10
6	1.00	.90	1.05	.80	.50	.80	1.00
7	.90	.90	1.00	.70	.50	.80	1.00
8	.90	1.00	1.00	.70	.50	.80	1.00
9	.90	.95	.90	.70	.50	.70	1.00
10	.90	.90	.90	.70	.50	.70	1.00
11	1.85	1.00	.90	.70	.50	.80	1.00
12	2.80	1.00	.90	.60	.50	.80	1.00
13	4.80	1.00	.90	.60	.50	.80	.90
14	3.80	1.00	.90	.60	.50	.70	.90
15	2.90	1.10	.90	.60	.50	.70	1.00
16	2.20	1.10	1.00	.60	.60	.70	1.00
17	1.95	1.10	1.00	.60	.60	.70	1.00
18	1.80	1.10	.90	.60	.60	.80	1.00
19	2.00	1.10	.90	.60	.60	.70	1.00
20	2.15	1.00	.90	.60	.60	.70	1.10
21	2.05	1.00	1.00	.60	.60	.80	1.25
22	1.70	1.00	1.10	.60	.60	.80	1.35
23	1.50	1.00	1.30	.60	.60	.80	1.40
24	1.40	.90	1.35	.60	.60	.90	1.50
25	1.30	1.10	1.20	.60	.60	.90	1.60
26	1.10	1.35	1.10	.50	.60	.90	1.60
27	1.00	1.50	1.05	.50	.60	.90	1.70
28	1.10	1.25	1.00	.50	.70	.90	1.85
29	1.10	1.15	1.00	.50	.70	.90	2.00
30	1.10	1.10	.90	.60	.70	1.00	2.10
31	.....	1.20	.90	.....	.70	.....	2.10

a Gage carried away by ice; replaced June 4.

CARRABASSETT RIVER AT NORTH ANSON, ME.

This river enters the Kennebec from the west at North Anson. Its basin has steep slopes, partly in farm lands, with no large natural reservoirs. Dams have been constructed and power used at New Portland, East New Portland, and North Anson.

This gaging station was established on October 19, 1901, by N. C. Grover. It is located above Embden Brook and below Anson Brook. The drainage area is 340 square miles at this point. Gagings are made by wading at low stages, or from a boat at high stages of the river. There are two gages; one is a vertical rod attached to a tree, the other is a standard chain gage attached to trees on the bank; length of chain, 36.73 feet. The datum of the two gages is the same, and is referred to two bench marks: (1) Point on root of a blazed spruce tree 40 feet from the vertical gage; elevation, 10.78 feet. (2) Copper bolt set in a large bowlder at the outlet of Anson Brook; elevation, 11.40 feet. The channel is straight 500 feet above the station and 300 feet below, and is about 150 feet wide, divided into two parts

at low stages of the river by a gravelly bar. The bed is of coarse gravel and permanent. Observed mean velocities range from 3.35 feet per second at gage height 2.68 feet to 0.93 of a foot per second at gage height 0.60 foot. The gage is read once daily by N. Q. Hilton, a farmer, in North Anson.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Carrabassett River at North Anson, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 26	N. C. Grover	0.45	208
July 17	F. E. Pressey	.90	348
August 15	do	.71	300
September 23	N. C. Grover	.15	76
November 6	F. E. Pressey	.30	165

Mean daily gage height, in feet, of Carrabassett River at North Anson, Me., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.90	1.90	0.20	0.50	1.40	0.40	0.20	0.30	0.40
2		2.50	1.90	.10	.60	1.00	.40	.10	.30	.30
3		2.20	1.30	.20	.80	.80	.40	.10	.30	.30
4		3.70	1.30	.20	.60	.70	.40	.10	.30	.30
5		4.00	1.20	.20	.50	.60	.30	.20	.20	.30
6		2.70	1.20	.20	.50	.50	.50	.50	.30	.40
7		2.30	1.20	.10	.50	.60	.30	.50	.40	.30
8		2.20	1.30	.10	.50	.50	.30	.40	.40	.40
9		3.50	1.20	.10	.50	.50	.30	.40	.30	.40
10		3.60	1.20	.10	.60	.50	.20	.60	.40	.50
11		3.30	1.30	.10	.50	.40	.30	.50	.30	.50
12		2.60	1.20	.10	.60	1.70	.20	.40	.40	.50
13		2.40	1.10	11.10	.60	1.20	.30	.40	.40	.60
14		2.20	1.00	8.30	.60	.90	.30	.50	.30	.60
15		2.20	1.00	4.10	.40	.70	.30	.40	.20	.60
16		2.20	.90	2.80	1.20	.50	.20	.40	.30	.80
17		2.10	.70	2.10	.90	.60	.30	.40	.30	.70
18		1.90	.70	1.80	.70	.60	.30	.70	.40	.80
19		1.70	.70	1.50	.50	.50	.30	1.30	.50	1.00
20		1.70	.70	1.80	.70	.60	.20	.80	.40	.90
21		1.60	.90	1.60	.70	1.60	.20	.70	.30	2.60
22		1.50	.70	1.40	1.40	1.10	.20	.60	.40	2.60
23		1.50	.60	1.20	1.20	.90	.20	.50	.40	2.50
24		1.50	.50	1.00	2.90	.70	.10	.50	.30	2.40
25		1.50	.50	.90	2.00	.60	.10	.50	.80	2.30
26		1.50	.50	.90	1.50	.60	.10	.50	1.10	2.30
27		1.40	.40	.80	1.10	.60	.10	.50	.50	2.40
28		1.50	.40	.70	.90	.60	.20	.40	.40	2.30
29	(a)	1.70	.40	.60	.80	.50	.30	.50	.30	2.30
30	2.10	1.90	.20	.60	1.00	.40	.30	.40	.30	2.00
31	2.40		.20		1.70	.40		.30		2.00

a Frozen January 1 to March 29.

Rating table for Carrabassett River at North Anson, Me., from November 1, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	60	1.1	625	2.1	1,495	3.1	2,580
.2	96	1.2	710	2.2	1,585	3.2	2,710
.3	135	1.3	795	2.3	1,680	3.3	2,840
.4	177	1.4	880	2.4	1,775	3.4	2,970
.5	223	1.5	965	2.5	1,875	3.5	3,100
.6	272	1.6	1,050	2.6	1,980	3.6	3,230
.7	327	1.7	1,135	2.7	2,090	3.7	3,360
.8	392	1.8	1,225	2.8	2,205	3.8	3,495
.9	464	1.9	1,315	2.9	2,325	3.9	3,630
1.0	542	2.0	1,405	3.0	2,450	4.0	3,765

Tangent at 3.7 feet gage height. Differences above this point 135 per tenth. Table extended above 4.3 feet gage height.

Estimated monthly discharge of Carrabassett River at North Anson, Me., for 1903.

[Drainage area, 340 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April[a]	3,765	880	1,706	5.02	5.60
May	1,315	96	516	1.52	1.75
June	13,350	60	1,340	3.94	4.40
July	2,325	177	503	1.48	1.71
August	1,135	177	379	1.11	1.28
September	223	60	123	.36	.40
October	795	60	217	.64	.74
November	625	96	177	.52	.58
December	1,980	135	771	2.27	2.62

[a] Frozen January 1 to March 29.

MESSALONSKEE RIVER AT WATERVILLE, ME.

This river enters the Kennebec from the west at Waterville. It has a total drainage basin of 205 square miles, of which 30 square miles are lake surface. From the lowest lake to the Kennebec there is a fall in 5 or 6 miles of 164 feet, which is practically all utilized.

The United States Geological Survey has maintained a gage at the dam of the Chase Manufacturing Company, in Waterville, since June

18, 1903. This gage is read twice daily by G. M. Glidden. The dam is a new crib, without leakage, and with a good crest. Generally the water is not used for power purposes at night, and the gage is read when the wheels are not running. At other times the amount of water used through the wheels is added to that which flows over the dam. Flashboards are maintained during low stages of the river.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Mean daily discharge, in second-feet, of Messalonskee River at Waterville, Me., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		183	148	119	59	60	59
2		220	112	129	59	49	59
3		205	176	119	70	59	59
4		148	212	119	61	57	59
5		159	231	89	81	66	61
6		169	205	112	54	70	33
7		169	205	138	59	73	19
8		176	183	111	51	61	51
9		127	127	111	66	66	59
10		159	212	104	36	59	59
11		142	205	104	94	66	59
12		127	194	84	94	73	145
13		169	183	89	81	59	100
14		142	194	89	70	19	51
15		142	176	111	81	41	54
16		148	112	111	75	73	51
17		243	138	111	73	59	59
18	212	231	176	99	60	59	54
19	194	159	182	84	41	59	17
20	169	194	182	48	73	59	157
21	136	194	199	112	73	66	306
22	169	194	159	212	73	61	291
23	183	293	183	220	73	59	167
24	183	314	118	19	70	59	252
25	169	194	138	26	47	59	72
26	176	169	138	41	81	59	72
27	148	159	129	66	73	59	72
28	118	176	119	94	73	73	53
29	142	176	89	73	73	54	45
30	176	209	106	59	66	76	59
31		176	124		41		112

COBBOSSEECONTEE RIVER AT GARDINER, ME.

Cobbosseecontee River drains a group of lakes lying from 5 to 15 miles westerly from Augusta, having areas aggregating 19 square miles, and empties into the Kennebec 6 miles below that city at Gardiner. Its total drainage area is about 240 square miles. From the ordinary surface of Lake Maranacook, one of the upper lakes, to mean tide at the mouth of the river the fall is 206 feet, and in the lower three-

fourths of a mile it is said to be 136 feet. From above the uppermost of the 8 dams controlled by the Gardiner Water Power Company, which are in the latter three-fourths of a mile, the municipal water supply for Gardiner is drawn and pumped by water power. Record is kept of the water pumped and of the water that passes the dam through a waste gate. The sum of these quantities represents the yield of the drainage area at the upper dam, records of which have been kept by the Gardiner Water Power Company for a series of years, and have been furnished to the Survey by their engineer, A. H. Twombly. The record for 1903 is presented in the accompanying table. On Sundays and on legal holidays the gates are closed and no water is permitted to run unless the lakes are full. This is a most remarkable example of the regularity of flow that can be obtained with proper storage.

Mean daily discharge, in second-feet, of Cobbosseecontee River at Gardiner, Me., for 1903.

Day.[a]	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	250	.....	1,011	1,085	280	280	280	280	270	250	.....	130
2	250	270	1,011	1,054	280	280	280	.....	270	250	220	140
3	250	270	768	803	.....	280	280	280	270	250	220	140
4	.....	270	663	846	280	280	.....	280	270	.....	220	140
5	250	270	637	735	280	280	.....	280	270	250	220	140
6	250	270	564	735	280	280	280	280	.....	250	220	.....
7	250	270	587	750	280	.....	280	280	.....	250	210	140
8	250	.....	848	645	280	280	280	280	270	250	.....	120
9	250	270	1,259	712	280	280	280	.....	270	250	210	115
10	250	270	1,815	712	.....	280	280	280	270	220	190	125
11	.....	270	3,243	687	280	280	280	280	270	.....	125	115
12	250	270	3,275	.....	280	280	.....	280	270	250	130	115
13	250	270	3,235	300	280	280	280	280	.....	250	130	.....
14	250	270	3,216	300	280	.....	280	280	270	250	130	150
15	250	.....	2,585	300	280	280	280	280	270	250	.....	150
16	250	270	2,497	300	280	280	280	.....	270	250	130	140
17	250	270	2,231	300	.....	280	280	280	270	250	130	145
18	.....	270	1,976	300	280	280	280	280	270	.....	130	145
19	250	280	1,779	26	280	280	.....	280	270	220	130	145
20	250	280	1,479	326	280	280	280	280	.....	220	130	.....
21	250	280	1,479	314	280	.....	280	280	270	220	130	220
22	250	14	1,479	306	280	280	280	270	270	220	.....	200
23	250	367	1,499	306	280	280	280	.....	250	220	130	200
24	250	450	1,722	300	280	280	280	270	250	220	130	200
25	.....	519	1,623	300	280	280	280	270	250	.....	130	.....
26	270	776	1,066	.....	280	280	.....	270	250	220	.....	200
27	270	515	1,110	300	280	280	280	270	.....	220	130	.....
28	270	489	1,136	300	280	.....	280	270	250	220	130	200
29	270	.....	1,111	300	280	280	280	270	250	220	.....	200
30	270	.....	886	300	280	280	280	.....	250	220	130	200
31	270	.....	906	.....	.....	.....	280	270	.....	220	.....	200

[a] Water shut back on Sundays and holidays.

ANDROSCOGGIN RIVER DRAINAGE BASIN.

Androscoggin River is formed by the junction of Magalloway River and the outlet of the Umbagog-Rangeley lakes near the Maine-New Hampshire boundary line. For about 35 miles it flows southward into the State of New Hampshire, then turns abruptly to the east and flows into the State of Maine, then turns to the south and joins the Kennebec in Merrymeeting Bay. The last fall on the Androscoggin is at Brunswick, Me., above which place the drainage area is 3,470 square miles, about 80 per cent of which is in Maine. The greatest length of the basin is 110 miles, the greatest width 70 miles, while the river itself measures about 200 miles in length from the sources of Magalloway River to the coast. The following table gives the drainage areas of the river and of some of its chief tributaries:

Drainage areas of Androscoggin River and principal tributaries.

River.	Locality.	Drainage area.
		Square miles.
Androscoggin	Immediately below junction of Umbagog outlet and Magalloway River, at Errol dam.	1,090
Do	Berlin	1,350
Do	Gorham	1,375
Do	Shelburne	1,500
Do	Rumford Falls	2,090
Do	Dixfield	2,230
Do	Livermore Falls	2,550
Do	Lewiston Falls	2,950
Do	Brunswick	3,470
Umbagog outlet	Immediately above junction with Magalloway River.	590
Magalloway	Mouth	500
Little Androscoggin	do	380

The lower part of the basin is hilly and moderately wooded, while the upper two-thirds is broken and mountainous, heavily timbered, and with a gravelly, sandy soil. Granite, gneiss, and mica-schists abound along the main course of the river, with clay slate in the upper part of the basin. The river, like others on the southern slopes of Maine, generally has a rocky bed, particularly where falls occur, has high banks, and is seldom subject to overflow, all of which are features of advantage in the development of water powers. Below Berlin the facilities for rail transportation are excellent. Tide-water navigation extends to the falls at Brunswick.

The United States Geological Survey now maintains gaging stations on this river at Shelburne, N. H., and Dixfield, Me.

ANDROSCOGGIN RIVER AT ERROL DAM, NEW HAMPSHIRE.

Four large storage dams are maintained in the Umbagog-Rangeley Lake system. They are located at the outlets of Rangeley, Mooselucmaguntic, Richardson, and Umbagog lakes. Errol dam, at the outlet of Umbagog Lake, is the lowest of the series and is below the mouth of Magalloway River. The other three dams control completely the flow from the basin above Richardson Lake, aggregating 520 square miles in area. Errol dam controls in part the run-off from a total area of 1,090 square miles, which includes the area tributary to Richardson Lake mentioned above, but its height is not sufficient to store the total freshet flow.

The United States Geological Survey, cooperating with Walter H. Sawyer, agent of the Union Water Power Company, Lewiston, Me., is making a series of measurements of flow through the gates at Errol dam. A continuous record of gate openings is kept and when a sufficient number of measurements have been made to warrant the construction of a rating curve for the gates a continuous record of flow at this point will be available. The results of these measurements are not yet ready for publication.

ANDROSCOGGIN RIVER AT GORHAM, N. H.

During the year 1903 the Berlin Mills Company constructed a tight crib dam in Androscoggin River at Gorham. From November 27, 1903, until the end of the year the total volume of the river was diverted through a carefully constructed rectangular notch in this dam and the daily discharge estimated from observed depths of water in the notch. The following record has been furnished by H. S. Ferguson, engineer for the company. The drainage area at this point is 1,375 square miles.

Mean daily discharge, in second-feet, of Androscoggin River at Gorham, N. H., for 1903.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1,492	12		1,251	22		852
2		1,598	13			23		
3			14		1,160	24		771
4		1,146	15		975	25		
5		1,270	16		1,016	26		709
6			17		1,082	27	1,600	466
7		1,251	18		1,083	28	1,492	474
8			19		1,060	29		
9		1,166	20			30	1,316	496
10		1,241	21		878	31		434
11		1,156						

ANDROSCOGGIN RIVER AT SHELBURNE, N. H

This station was established May 30, 1903, by N. C. Grover. It is located at the steel highway bridge about one-half mile north of the railway station at Shelburne. The drainage area at this point is 1,500 square miles. A standard chain gage is attached to the guard timber on the downstream side of the bridge; length of chain, 20.66 feet. It is referred to bench marks as follows: (1) Marked point on south edge of most westerly cylindrical pier; elevation, 17.82 feet. (2) Marked point on lower chord, near gage; elevation, 18.77 feet. (3) Highest point of bowlder near most easterly pier; elevation, 7.14 feet. All elevations refer to the datum of the gage. The initial point for soundings is on the left bank of the river at the end of the inclined end post of the downstream truss. The channel of the river is straight for 500 feet above and 1,000 feet below the station, is about 400 feet wide at ordinary stages, and is broken by two piers. The bed of the river is sandy and usually permanent, but in case of serious obstructions to the channel by ice or logs, noticeable changes take place. The velocity is swift and fairly well distributed throughout the cross section. The lowest mean velocity observed is 1.74 feet per second. The banks on both sides are subject to overflow in extreme freshets. The gage is read twice daily by James Simpson, postmaster at Shelburne.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Androscoggin River at Shelburne, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 30	N. C. Grover	5.12	3,332
August 13	F. E. Pressey	4.51	1,991
September 3	do	4.33	1,636
October 2	do	4.30	1,628

Mean daily gage height, in feet, of Androscoggin River at Shelburne, N. H., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.10	4.25	4.40	4.30	4.20	4.30	4.50
2		4.95	4.20	4.30	4.30	4.30	4.30	4.50
3		4.95	4.25	4.35	4.30	4.30	4.30	4.50
4		4.90	4.20	4.15	4.30	4.30	4.30	4.50
5		5.00	4.25	4.30	4.30	4.30	4.30	4.80
6		5.05	4.25	4.25	4.30	4.30	4.30	5.25
7		4.95	4.25	4.20	4.30	4.40	4.30	4.85
8		4.95	4.20	4.30	4.30	4.35	4.30	4.90
9		5.45	4.20	4.30	4.30	4.35	4.30	4.80
10		4.40	4.30	4.30	4.30	4.50	4.30	4.80
11		4.20	4.35	4.35	4.20	4.40	4.30	4.90
12		5.15	4.50	4.30	4.20	4.40	4.30	4.80
13		8.35	4.65	4.30	4.20	4.40	4.30	5.40
14		6.00	4.60	4.30	4.20	4.40	4.30	(a)
15		5.40	4.40	4.30	4.20	4.35	4.30	.....
16		5.05	4.35	4.30	4.20	4.30	4.30	.....
17		5.05	4.30	4.30	4.25	4.30	4.35	.....
18		4.55	4.15	4.20	4.30	4.40	4.40	.....
19		4.70	3.95	4.20	4.30	4.30	4.30	.....
20		3.85	4.00	4.30	4.30	4.30	4.30	6.70
21		4.45	4.60	4.30	4.25	4.30	4.30	.....
22		4.75	4.55	4.30	4.25	4.30	4.30	.....
23		4.85	4.80	4.30	4.30	4.30	4.30	.....
24		4.35	4.65	4.35	4.20	4.30	4.30	.....
25		4.35	4.60	4.30	4.20	4.30	4.30	.....
26		4.25	4.70	4.30	4.20	4.40	4.30	.....
27		4.30	4.60	4.30	4.20	4.35	4.30	6.50
28		4.35	4.55	4.30	4.20	4.30	4.40	.....
29		4.35	4.50	4.35	4.20	4.30	4.50	.....
30	5.10	4.35	4.45	4.30	4.20	4.30	4.50	.....
31	5.15	.....	4.45	4.30	.....	4.30	.....	.....

a Readings December 14 to 31 through ice.

ANDROSCOGGIN RIVER AT RUMFORD FALLS, ME.

One of the finest water powers in the Atlantic Coast drainage is at Rumford Falls. Here the Androscoggin descends 177 feet in 1 mile in several pitches over granite ledges. A comprehensive plan of development has been laid out and partly executed. It contemplates the use of power from three levels—a high-level canal, with a fall of 97 feet to the middle level, which receives also a direct and independent supply of water from the river. The water in the middle-level canal is then used and discharged after a fall of 50 feet into the low level, from which in turn there is a final drop of 30 feet to the river. Dams have been built at the entrance of the high and middle level canals. At present about 19,000 horsepower are utilized, largely in the manufacture of pulp and paper. An economical development of the entire fall of 177 feet would furnish 50,000 horsepower. This power is 85 miles by rail from Portland, and for pulp and paper

manufacture has the advantage of excellent transportation facilities. Androscoggin River is used for floating down pulp wood and timber from the headwaters to the mills, and the Rumford Falls and Rangeley Lakes Railroad, extending into the forests with its extension into the Megantic region, makes available the remoter resources of spruce, poplar, and birch.

The discharge of Androscoggin River at Rumford Falls since 1892 has been computed by Charles A. Mixer, resident engineer of the Rumford Falls Power Company. These statistics are obtained by adding the actual measured quantities passing through the wheels to the computed flow over the dam, using the customary Francis weir formula with modified coefficient. They have been published from time to time by the United States Geological Survey, and a complete record up to 1902 will be found in Water-Supply Paper No. 69.

Mean daily discharge, in second-feet, of Androscoggin River at Rumford Falls, Me., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,268	2,037	4,518	9,542	5,609	2,828	2,018	2,065	1,736	1,488	1,418	1,538
2	2,318	2,436	3,845	7,442	4,948	2,727	2,230	1,580	1,458	1,446	1,991	1,548
3	2,273	2,409	3,604	6,733	5,434	2,630	2,264	1,652	1,570	1,435	1,943	1,570
4	2,130	2,310	3,317	9,694	6,354	2,620	1,824	2,104	1,658	1,424	1,842	1,610
5	2,422	2,286	3,130	9,621	6,122	2,660	1,724	1,758	1,836	1,575	1,866	1,456
6	2,567	2,263	2,902	7,004	4,877	2,461	1,878	1,596	1,601	1,634	1,937	1,513
7	2,382	2,226	2,835	6,376	4,870	2,380	1,899	1,702	1,496	1,642	2,013	1,550
8	2,370	2,182	2,883	6,551	4,927	2,714	1,820	1,761	1,531	1,726	1,808	1,498
9	2,248	2,049	4,682	8,473	5,192	3,042	1,683	1,528	1,303	2,319	1,791	1,466
10	2,094	1,986	6,824	9,227	5,559	2,903	1,643	1,672	1,238	2,453	1,687	1,241
11	1,811	2,036	8,126	8,621	5,960	2,172	1,970	1,672	1,466	1,886	1,724	1,368
12	2,144	2,091	10,663	8,262	5,722	4,148	1,647	2,619	1,769	1,975	1,715	1,427
13	2,093	2,286	10,243	8,274	4,756	26,788	1,805	2,490	1,423	2,065	1,721	1,508
14	2,010	2,335	9,832	7,695	4,543	14,949	2,071	2,164	1,681	1,974	1,742	1,399
15	2,060	2,245	9,793	7,900	4,081	6,274	1,816	1,904	1,701	1,831	1,832	1,280
16	2,121	2,280	9,694	7,934	3,458	4,288	1,903	1,650	1,552	1,794	1,822	1,307
17	2,092	2,222	8,740	7,481	3,299	4,091	2,027	1,745	1,605	1,852	1,865	1,216
18	1,835	2,104	8,388	6,880	3,156	4,432	1,990	1,678	1,659	2,692	2,080	1,150
19	1,906	1,976	10,255	6,185	3,234	2,794	1,679	1,547	1,620	2,710	2,014	1,219
20	1,910	1,918	17,953	5,746	3,187	2,570	1,830	1,847	1,415	2,183	1,848	1,525
21	1,948	1,829	19,043	5,430	3,130	2,346	3,343	2,922	1,440	1,958	1,687	3,244
22	2,184	1,727	16,871	5,231	3,035	6,393	3,472	2,593	1,397	1,821	1,586	2,914
23	2,376	1,847	16,102	4,949	2,942	4,663	3,652	1,872	1,428	1,828	1,770	2,110
24	2,352	1,826	17,827	4,992	2,762	3,249	4,289	1,555	1,391	1,960	1,772	1,934
25	2,037	1,824	19,756	4,675	2,885	2,891	2,778	2,011	1,354	1,740	1,214	1,942
26	2,136	1,756	15,788	4,224	2,877	2,715	2,907	2,194	1,282	1,918	1,147	1,776
27	2,141	1,798	13,173	4,509	2,880	2,548	3,038	1,918	1,272	1,838	1,379	1,513
28	2,244	1,979	11,652	4,361	2,818	2,056	2,638	1,888	1,495	1,719	1,433	1,430
29	2,300	.....	10,492	4,926	2,928	2,201	2,214	1,955	1,531	1,694	1,502	1,396
30	2,429	.....	9,202	5,536	2,818	2,058	2,280	1,513	1,477	1,769	1,516	1,340
31	2,461	.....	9,391	.....	2,609	.....	2,011	1,742	.....	1,896	.....	1,308

ANDROSCOGGIN RIVER AT DIXFIELD, ME.

This station was established August 22, 1902, by F. E. Pressey. It is located about one-half mile west of Dixfield, at the highway bridge on the road to West Peru. The measurements are made from this bridge or from a boat at low water. The initial point for soundings is at the lower end of the inclined end post of the downstream truss on the left bank of the river. The gage is of the standard chain type: the scale board is nailed to the guard timber on the lower side of the bridge; length of chain, 31.76 feet. It is referred to bench marks as follows: (1) Southeast corner of bridge seat on north abutment; elevation, 24.77 feet. (2) Copper bolt in ledge under east end of bridge; elevation, 11.53 feet. (3) Top of short post at west hanger in east span; elevation, 33.15 feet. All elevations refer to the datum of the gage. The channel is straight for 1,000 feet above and one-half mile below the station, and is about 600 feet wide, broken by three piers. The current is swift in the left half and sluggish in the right half. Observed mean velocities range from 3.28 feet per second at gage height 10.59 to 0.97 of a foot per second at gage height 8.02. The banks are high and are not liable to overflow. The bed of the stream is rocky in the left half and sandy in the right half. The gage is read twice daily by S. F. Robinson.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Androscoggin River at Dixfield, Me., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 9	F. E. Pressey	10.59	11,041
June 23	do	9.86	8,364
Do	do	9.58	6,936
August 11	do	8.02	2,004
May 28	N. C. Grover	8.76	3,343
October 12	F. E. Pressey	8.07	2,218

Mean daily gage height, in feet, of Androscoggin River at Dixfield, Me., for 1903.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		10.55	11.15	9.90	8.70	8.15	8.15	8.00	7.80	8.05	8.05
2		12.15	10.60	9.55	8.75	8.15	8.05	7.90	7.80	8.05	8.05
3		11.10	10.20	9.65	8.75	8.30	7.80	7.80	7.80	8.05	7.90
4		10.75	11.00	9.90	8.65	8.20	8.15	7.95	7.80	7.95	8.00
5		10.30	11.15	9.90	8.65	8.10	8.05	8.00	7.85	8.05	8.00
6		9.50	10.40	9.55	8.70	8.00	7.85	8.00	7.90	8.05	7.90
7		8.95	10.15	9.40	8.95	8.05	7.85	8.00	7.95	8.15	7.90
8		9.15	10.15	9.55	8.70	8.05	8.00	7.90	7.95	8.00	8.00
9		9.55	10.60	9.70	8.60	7.95	7.95	7.75	8.15	7.90	7.90
10		10.65	10.95	9.70	8.65	7.95	8.00	7.60	8.45	8.00	7.90
11		11.10	10.70	9.65	8.35	8.05	7.95	7.70	8.20	7.90	7.80
12		12.05	10.50	9.75	8.10	8.15	8.35	7.90	8.05	8.00	8.00
13		11.50	10.60	9.55	13.85	7.95	8.45	7.95	8.10	7.95	7.85
14		11.10	10.45	9.40	13.45	8.15	8.25	7.90	8.10	7.95	7.95
15		11.20	10.50	9.30	10.20	8.00	8.10	7.85	8.00	7.95	8.70
16		11.05	10.45	9.00	9.40	8.00	8.10	7.80	7.95	7.95	9.60
17		10.70	10.35	8.95	9.10	8.10	8.10	7.85	8.00	8.00	9.55
18		10.65	10.30	8.90	8.80	8.10	8.05	7.90	8.45	8.15	9.25
19		10.75	10.10	8.85	8.65	8.00	7.90	7.95	8.75	8.10	9.20
20		12.75	9.85	8.80	8.65	7.85	7.95	7.80	8.30	8.00	9.15
21		13.75	9.70	8.80	8.40	8.60	8.70	7.80	8.05	7.95	10.40
22		12.90	9.65	8.80	9.40	9.15	8.55	7.80	8.00	7.80	10.85
23		12.55	9.50	8.75	9.55	8.95	8.25	7.80	8.00	7.95	9.85
24		13.00	9.60	8.80	8.90	9.45	7.90	7.80	8.15	7.95	9.60
25		13.75	9.45	8.70	8.55	8.70	8.00	7.80	8.05	7.70	(a)
26		12.75	9.50	8.70	8.65	8.65	8.20	7.80	8.00	7.65	.....
27	(b)	11.85	9.40	8.70	8.50	8.75	8.05	7.70	8.00	7.90	9.00
28	c 9.60	11.50	9.35	8.65	8.40	8.50	8.00	7.85	7.95	7.95	.....
29		11.25	9.55	8.75	8.35	8.25	8.05	7.95	7.90	8.00	.....
30		10.85	9.75	8.70	8.25	8.30	8.00	7.90	7.85	8.05	.....
31		10.80	.....	8.70	.....	8.15	7.90	.....	8.00	.....	9.70

a Readings December 16 to 31 through ice.
b Frozen January 1 to February 27.
c Possibly backwater from ice jams between February 28 and March 21.

Rating table for Androscoggin River at Dixfield, Me., from August 22, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
7.5	880	8.4	3,210	9.3	6,190	10.2	9,460
7.6	1,065	8.5	3,530	9.4	6,540	10.3	9,850
7.7	1,270	8.6	3,850	9.5	6,890	10.4	10,250
7.8	1,495	8.7	4,170	9.6	7,245	10.5	10,655
7.9	1,740	8.8	4,500	9.7	7,605	10.6	11,070
8.0	2,005	8.9	4,830	9.8	7,965	10.7	11,490
8.1	2,290	9.0	5,165	9.9	8,330	10.8	11,910
8.2	2,590	9.1	5,505	10.0	8,700	11.0	12,750
8.3	2,900	9.2	5,845	10.1	9,080		

Tangent at 10.6 feet gage height. Differences above this point 420 per tenth.

Estimated monthly discharge of Androscoggin River at Dixfield, Me., for 1902 and 1903.

[Drainage area, 2,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
August 22–31			3,688	1.65	0.61
September	5,505	970	3,206	1.44	1.61
October	14,220	1,380	3,763	1.69	1.95
November	7,065	3,530	4,592	2.06	2.30
December 1–8 [a]			3,054	1.37	.41
1903.					
March	24,300	4,995	14,109	6.33	7.30
April	13,380	6,365	9,495	4.26	4.75
May	8,330	4,010	5,856	2.63	3.03
June	24,720	2,290	5,702	2.56	2.86
July	6,715	1,615	2,876	1.29	1.49
August	4,170	1,495	2,272	1.02	1.18
September	2,005	1,065	1,641	.74	.83
October	4,335	1,495	2,150	.96	1.11
November	2,440	1,165	1,935	.87	.97
December 1–15 [b]			2,011	.90	.50

[a] Frozen December 9, 1902, to February 27, 1903.

[b] Frozen December 16 to 31, 1903

PRESUMPSCOT RIVER DRAINAGE BASIN.

This is one of the most interesting as well as one of the best water-power streams of its size in the United States. It is the outlet of Sebago Lake, which lies about 17 miles northwest of Portland. The lake is fed by Crooked River, a stream heading 35 miles farther north and within 3 miles of the Androscoggin. The area of the lake is 50 square miles, the area of its drainage basin at the outlet of the lake 420 square miles, and the total drainage area of the river at its mouth 600 square miles. The northern part of the basin is mountainous and wooded, while the southern part is moderately hilly and cleared of trees. Granite, gneiss, and mica-schists appear at many points, and the soil is gravelly and sandy.

According to the survey made by Joseph A. Warren, of Cumberland Mills, the fall from the crest of the stone dam at the foot of Sebago Lake to mean low tide at the foot of the lower falls is 265.16 feet in a distance of 21.65 miles, or an average of 12.25 feet per mile. In the lower two-thirds of this distance, or from Gambo Falls to tide

water, nearly one-half of the whole fall, or 132 feet, has been developed, and an aggregate probably exceeding 6,000 net horsepower is in use. The remainder of the fall, however, between Gambo Falls and Sebago Lake, amounting to 133 feet, is either unimproved or but slightly utilized. At Great Falls, in this stretch, there is a descent of 22 feet, which has been used in the past but is now idle. It is proposed, however, to employ the power in the generation of electricity for delivery in Portland.

The tributaries of Presumpscot River are not of much importance, but some of them are outlets of ponds and have considerable fall, thus affording constant though small power. Crooked River, the chief feeder of Sebago Lake, has a number of falls, some of which are utilized.

The chief interest attaching to the river is its regularity of flow, which is due to dams at the outlet of the lake. Nowhere in the United States is there a better example of the success of storage of water and regulation of the flow of a stream than on the Presumpscot.

PRESUMPSCOT RIVER AT OUTLET OF SEBAGO LAKE.

Since January, 1887, the flow from Sebago Lake has been regularly recorded, the quantity being deduced from the openings in the gates at the dam, the discharging capacity of which under different conditions of head has been determined and tabulated by Hiram F. Mills, of Lowell. Since January, 1872, a continuous record of the level of the lake surface has been kept. An unusually complete and valuable series of data has thus been obtained, which has been furnished to the United States Geological Survey by S. D. Warren & Co. The lake fills rapidly after the 1st of March, attaining its maximum height between the middle of April and June 1, and then gradually subsides as water is withdrawn for mill purposes, until a minimum stage is reached, sometimes in the autumn, but usually in the winter. The records of the daily discharge of the river at the outlet of the lake, published in Water-Supply Paper No. 69, show the remarkable uniformity of flow, which, as already stated, is due largely to artificial regulation. On Sundays the gates are closed, so that only the waste is allowed to reach the river.

The following table shows the estimated daily flow for 1903:

Mean daily discharge, in second-feet, of Presumpscot River at outlet of Sebago Lake for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	770	125	133	640	730	720	703	760	745	751	250	683
2	770	730	740	640	730	720	703	300	745	751	728	683
3	770	730	740	640	300	720	703	750	745	751	728	683
4	125	730	740	640	690	720	703	750	745	300	728	683
5	723	730	740	267	690	720	300	750	745	742	728	683
6	723	730	740	800	690	720	703	750	300	742	728	250
7	723	730	740	800	690	300	703	750	733	742	728	667
8	723	130	133	800	690	695	703	750	733	742	250	667
9	723	730	760	800	690	695	703	300	733	742	728	667
10	723	730	760	800	250	695	703	800	733	742	728	667
11	123	730	760	800	67	695	703	800	733	300	728	667
12	723	730	760	333	67	695	300	722	733	742	728	667
13	723	730	760	550	67	695	700	722	300	742	728	250
14	723	730	760	550	747	300	700	722	750	742	728	667
15	723	130	133	550	747	700	700	722	750	742	250	667
16	723	733	793	700	747	700	700	300	750	742	717	667
17	723	733	793	700	300	700	700	722	750	742	717	667
18	123	733	793	700	740	700	700	722	750	300	717	667
19	542	733	793	300	740	700	300	722	750	728	717	667
20	542	733	650	655	740	700	750	722	300	728	717	250
21	542	733	650	655	740	300	750	722	743	728	717	567
22	723	133	137	655	740	700	750	722	743	728	250	567
23	723	552	667	655	740	700	750	300	743	728	700	567
24	723	552	667	655	300	700	750	717	743	728	700	700
25	123	552	667	655	783	700	750	717	743	250	700	700
26	542	552	667	267	783	700	300	717	743	742	700	700
27	542	552	667	730	783	700	738	717	300	742	773	250
28	723	727	667	730	783	300	738	717	750	742	773	678
29	723	.....	300	730	783	703	760	717	750	742	250	678
30	723	.....	640	730	783	703	760	300	750	742	683	678
31	723	.....	640	.....	300	.....	760	733	.....	742	.....	678

SACO RIVER DRAINAGE BASIN.

This river receives its headwaters from the valleys and slopes of the White Mountains at elevations of 4,000 to 5,000 feet. It drains an area of 1,720 square miles, of which 900 square miles lie in New Hampshire and the remainder in Maine. The slopes at the headwaters are very steep, with no lake storage. In the lower river are many good water powers, part of which are in use. The upper portions of the basin are generally in forest, but much of the large growth has been cut, and over large areas the evergreen trees have been entirely removed. In the lower basin are many farms and villages. The underlying rock is generally granite, appearing at the surface in many mountain summits.

SACO RIVER AT CENTER CONWAY, N. H.

This station was established August 26, 1903, by N. C. Grover. It is located at the wooden highway bridge between Center Conway and Redstone, about 2 miles from each place. The drainage basin at this point has an area of 385 square miles. A standard chain gage is attached to the floor of the bridge; length of chain, 30.44 feet. It is referred to bench marks as follows: (1) Marked point on lower chord of bridge near gage; elevation, 27.72 feet. (2) South end of top of west abutment; elevation, 25.14 feet. The channel is straight for 2,000 feet above and 300 feet below the station, and is about 200 feet wide at ordinary stages, broken by one pier. The banks are high and are not liable to overflow, except in very extreme freshets. The bed is of sand and gravel and is permanent. At low water the observed mean velocity is small, being 1.18 feet per second at gage height 4.3. Low-water measurements are usually made by wading about 400 feet above the bridge, where a mean velocity of 1.22 feet per second was observed at gage height 3.92. The gage is read twice daily by Albert P. Davidson.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Saco River at Center Conway, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 26	H. K. Barrows	4.31	504
August 27	do	4.13	382
September 19	do	3.92	359

Mean daily gage height, in feet, of Saco River at Center Conway, N. H., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.94	3.54	4.01		17		3.62	4.00	3.78	
2		3.94	3.50	4.00		18		4.06	6.52	4.18	
3		3.93	3.50	4.02		19		3.52	5.30	4.00	4.50
4		3.90	3.51	3.90		20		3.71	4.70	3.78	
5		3.92	3.52	3.92		21		3.60	4.45	3.79	
6		3.91	3.55	4.05	3.90	22		3.60	4.25	3.61	
7		3.80	3.53	3.96		23		3.50	4.22	3.88	
8		3.67	3.62	3.95		24		3.48	4.30	3.72	
9		3.68	5.12	3.88		25		3.50	4.22	3.90	
10		3.67	5.65	3.85		26	4.13	3.50	4.28	4.10	
11		3.70	4.82	3.85		27	4.13	3.52	4.22	(a)	
12		3.65	4.40	3.80	4.00	28	4.98	3.55	4.00		
13		3.65	4.32	3.78		29	3.98	3.58	4.00		
14		3.62	4.22	3.72		30	3.95	3.55	3.98		
15		3.55	4.05	3.75		31	3.95		4.08		
16		3.54	4.02	3.80							

a Readings November 27 to December 31 through ice.

MERRIMAC RIVER DRAINAGE BASIN.

This basin, which has a total drainage area of 5,015 square miles, lies in the States of New Hampshire and Massachusetts; of this, 3,815 square miles are in the former State and 1,200 square miles in the latter. Merrimac River is formed at Franklin, N. H., by the junction of Pemigewasset and Winnepesaukee rivers. The headwaters of the Pemigewasset lie in the White Mountain region at elevations of approximately 2,000 feet; thence they flow southerly through New Hampshire with very steep slopes. On this branch of the Merrimac there is very little lake storage. Squam and New Found lakes, aggregating about 20 square miles of surface area, are the only bodies of water of any importance. Above Plymouth probably 85 per cent of the basin is in heavy forest. A very insignificant amount of water power is utilized. The total drainage area of Pemigewasset River is 1,085 square miles. Winnepesaukee River has its headwaters in the eastern part of the State. It drains an area of 435 square miles. A prominent characteristic of its basin is the extent of the lake surface, aggregating 100 square miles. The fall from Winnepesaukee Lake to the junction with Pemigewasset River is 225 feet in a distance of 14 miles.[a]

From Franklin, Merrimac River flows southerly through the State of New Hampshire for 56 miles, receiving Contoocook River from the west and Suncook River from the east. After entering Massachusetts the river deflects to the east and flows in an easterly and northeasterly direction, a distance of 40 miles, to Newburyport, where it enters an arm of the sea. Tide flows to Lawrence.

The United States Geological Survey maintains gaging stations in this basin on Merrimac River at Franklin Junction; on Pemigewasset River at Plymouth; on Contoocook River at West Hopkinton.

MERRIMAC RIVER AT FRANKLIN JUNCTION, N. H.

This station was established July 8, 1903, by H. K. Barrows. It is located at the wooden railway bridge near Franklin Junction, about a mile below the union of Pemigewasset and Winnepesaukee rivers. The drainage area at this point is 1,460 square miles. A standard chain gage is fastened to the guard timber of the bridge; length of chain, 47.08 feet. It is referenced by bench marks as follows: (1) Marked point on lower chord near gage; elevation, 46.54 feet. (2) Top of north rail at west portal of bridge; elevation, 47.08 feet. (3) Spike in telegraph pole nearest west end of bridge; elevation, 46.38 feet. (4) Top of northwest nut on guard timber; elevation, 47.28 feet. All elevations refer to the datum of the gage. The initial point for soundings is at the top of the face of the right abutment at the upstream

[a] 10th Census, vol. 16, p. 50.

side of the bridge. The channel is straight above and below the bridge, and is about 200 feet wide at ordinary stages, broken by one pier. The banks are high and rocky and not subject to overflow. The bed is rocky and permanent. The current is swift, having an observed mean velocity of 1.53 feet per second at a gage height of 4.20, the lowest measurement made. The gage is read twice daily by F. R. Roers.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Merrimac River at Franklin Junction, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 13	H. K. Barrows	4.46	1,485
July 14	do	4.42	1,422
July 31	do	4.66	1,625
September 5	do	4.67	1,680
September 9	do	4.20	1,140
October 8	N. C. Grover	4.17	1,073

Mean daily gage height, in feet, of Merrimac River at Franklin Junction, N. H., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.55	4.30	.....	4.25	3.90	17	4.30	4.35	4.10	4.30	4.20	4.30
2	.....	4.25	4.30	.....	4.25	3.95	18	4.35	4.40	4.15	4.30	4.50	4.45
3	.....	4.35	4.35	4.10	4.30	4.00	19	3.85	4.40	4.15	5.10	4.65	4.80
4	.....	4.35	4.30	3.30	4.35	4.00	20	4.25	4.40	3.90	5.10	4.40	4.80
5	.....	4.40	4.45	3.95	4.35	3.90	21	5.15	5.40	4.00	4.80	4.20	5.45
6	.....	4.40	4.00	4.10	4.35	3.80	22	5.70	4.25	4.10	4.65	3.90	6.20
7	.....	4.40	3.95	4.10	4.50	3.90	23	5.40	4.45	4.00	4.45	4.15	5.20
8	4.80	4.40	4.05	4.15	3.90	4.00	24	5.50	4.45	4.00	4.40	4.25	4.60
9	4.35	3.90	4.15	4.50	4.05	4.00	25	5.40	4.50	4.00	4.20	4.10	4.60
10	4.35	.....	4.15	4.80	4.25	3.95	26	4.20	4.50	4.00	4.25	4.05	4.65
11	4.50	.....	4.25	4.30	4.25	4.05	27	4.55	4.50	3.80	4.35	4.10	4.50
12	4.15	4.45	4.15	4.40	4.20	4.20	28	4.35	4.40	3.90	4.40	4.00	4.60
13	4.50	5.20	3.50	4.40	4.30	4.10	29	4.50	4.40	4.10	4.45	3.80	4.70
14	4.25	4.90	4.05	4.40	4.40	4.10	30	4.55	4.25	4.10	4.30	3.90	4.70
15	4.30	4.55	4.05	4.40	4.10	4.40	31	4.55	4.15	.....	4.30	.....	4.70
16	4.25	3.95	4.05	4.30	4.10	4.35							

MERRIMAC RIVER AT LAWRENCE, MASS.

Records of flow of this river at Lawrence have been kept for more than fifty years, but have never been published in full. Figures for the monthly maximum and minimum discharges from 1890 to 1897 were published in the Nineteenth Annual Report, Part IV; the daily discharge for 1897, 1898, and 1899, in Water-Supply Paper No. 35; the daily discharge for 1900, in Water-Supply Paper No. 47; the daily discharge for 1901 and 1902, in Water-Supply Paper No. 82. These figures are furnished by R. A. Hale, principal assistant engineer of the Essex Water Power Company.

For a portion of the year water from the Sudbury and Nashua drainage basins is wasted into the Merrimac, and therefore the drainage area is a somewhat variable quantity. During the dry months a very small amount is received. The following tables give the flow of the Merrimac at Lawrence, also the quantity wasted from the Sudbury and Nashua drainage basins, that reaches the Merrimac. The latter table is based on data furnished by the Metropolitan Water and Sewerage Board of Boston. The drainage areas are as follows:

Drainage areas in Merrimac Basin.

	Sq. miles.
Total Merrimac River drainage basin above Lawrence	4,664
Nashua River drainage basin above gaging station	119
Sudbury drainage basin, Framingham, Dam No. 1	75
Cochituate drainage basin	19
Total Nashua, Sudbury, and Cochituate drainage basins	213
Net drainage basin of Merrimac, excluding Nashua, Sudbury, and Cochituate basins	4,451

The quantity as measured at Lawrence includes the water from Sudbury, Nashua, and Cochituate, and in getting the absolute yield of the river this should be considered in reference to the drainage areas, either by deducting it from the Merrimac flow and using the net area of the Merrimac and the net flow of the Merrimac, or by getting the total yield of both the Sudbury and Nashua with the Merrimac and using the total area.

Mean daily discharge, in second-feet, of Merrimac River at Lawrence, Mass., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8,473	9,033	26,761	25,268	6,748	2,005	7,708	3,652	2,890	2,444	1,890	2,906
2	8,298	10,077	30,045	25,675	6,971	1,637	7,304	3,011	2,982	2,574	4,264	2,741
3	7,877	9,401	27,928	22,025	6,212	1,541	6,891	4,639	3,481	1,675	3,065	2,717
4	8,850	9,689	22,588	20,112	6,132	2,540	5,248	3,243	2,921	339	3,176	2,762
5	11,264	11,622	19,177	20,008	5,905	2,701	4,718	3,332	1,785	2,649	3,012	1,686
6	11,137	12,443	17,744	21,321	6,042	1,773	5,591	3,542	1,804	2,529	3,042	426
7	10,448	11,056	15,694	18,395	6,071	562	4,742	4,267	2,254	2,415	1,956	3,170
8	9,586	9,123	15,260	17,323	5,901	3,622	3,836	3,842	4,111	2,567	1,789	2,327
9	8,630	8,309	22,311	19,760	5,575	2,804	4,419	3,286	3,012	2,705	4,139	2,717
10	7,096	7,876	32,304	21,866	5,008	2,729	4,392	4,834	2,838	1,686	3,142	2,773
11	6,449	8,040	37,542	20,907	4,505	2,741	2,822	3,318	2,574	2,795	3,019	3,163
12	7,355	9,279	43,867	17,917	4,973	2,940	2,447	3,276	1,602	5,950	3,028	2,210
13	6,420	12,856	45,469	16,515	5,001	3,579	4,371	3,295	304	5,910	2,989	2,077
14	6,776	13,930	39,851	15,341	4,877	11,930	3,439	3,852	3,110	6,218	1,892	4,465
15	7,136	12,752	32,205	14,362	4,677	16,400	3,200	3,166	2,792	5,347	1,163	4,440
16	7,179	11,861	29,438	15,634	4,324	15,400	3,519	2,242	2,579	5,223	3,767	3,723
17	6,379	9,919	25,507	17,833	3,770	17,200	3,126	4,127	2,668	3,394	3,064	4,098
18	5,645	8,461	22,441	17,242	4,404	14,200	2,131	2,939	2,509	3,909	3,232	3,438
19	6,549	8,209	21,163	14,702	3,902	11,520	2,266	2,824	1,688	5,806	4,187	2,323
20	5,954	8,095	20,566	13,556	3,910	9,410	4,470	2,667	331	6,145	4,641	1,668
21	5,930	7,365	23,260	12,600	3,804	7,890	3,877	2,668	3,419	5,608	3,504	5,306
22	7,257	7,038	28,051	11,533	3,656	24,400	5,641	2,350	2,763	5,164	2,803	9,348
23	8,590	7,890	31,840	10,258	3,168	35,600	7,856	2,847	2,581	4,463	4,430	8,833
24	8,187	7,245	37,098	10,220	2,407	28,384	7,270	4,220	2,325	3,043	3,375	7,195
25	7,965	7,192	39,050	9,453	3,373	21,521	6,530	3,108	2,333	3,061	3,093	5,121
26	8,026	7,024	37,107	8,331	3,312	18,112	5,082	3,054	1,563	4,871	1,114	4,730
27	7,064	6,896	29,868	8,469	2,487	14,994	5,526	3,417	373	4,076	3,787	4,111
28	6,662	7,964	23,361	7,221	2,705	11,757	4,194	3,477	2,833	3,150	2,378	5,144
29	6,672	.....	20,328	6,951	2,788	10,296	3,951	2,373	2,361	3,278	1,257	3,489
30	7,125	.....	19,778	6,815	2,054	8,659	3,846	2,327	2,358	3,317	3,751	3,059
31	7,705	.....	20,322	.....	653	.....	3,668	4,293	.....	2,238	.....	3,155

PEMIGEWASSET RIVER AT PLYMOUTH, N. H.

This station was established September 5, 1903, by N. C. Grover. It is located at the wooden highway bridge below the mouth of Bakers River in the town of Plymouth. The drainage area at this point is 615 square miles. The headwaters of the river lie in the mountainous country to the west of Mount Washington, at elevations of more than 2,000 feet. At North Woodstock, Pemigewasset River is formed by the junction of East Branch, Middle Branch, and Moosilauke Brook, at an elevation of about 700 feet. Thence the waters flow south, receiving Mad River from the east and Bakers River from the west, until at Plymouth, about 20 miles below North Woodstock, the elevation is between 400 and 500 feet. The underlying rock in this basin is usually granite, exposed in the mountain summits. The basin contains some of the best spruce standing in New England. Large areas in the basin of East Branch are still in virgin forest; other areas have

been practically stripped, especially on Hancock Brook, a tributary of East Branch, and in the basin of Middle Branch.

The height of water at Plymouth has been recorded daily since January 1, 1886, during which time extensive deforestation in the basin above has taken place. This record of gage height has been kindly given to the United States Geological Survey by Locks and Canals Company, of Lowell, Mass. From these the daily discharge of the river since that date can be estimated when a sufficient number of measurements of flow at the station has been made to warrant the construction of a rating table.

A standard chain gage is attached to the guard rail of the sidewalk of the bridge on the upstream side; length of chain, 34.69 feet. It is referred to bench marks as follows: (1) Marked point on rail of bridge near gage; elevation, 34 feet. (2) North corner of intermediate granite gage set by Locks and Canals Company of Lowell, Mass.; elevation, 13.27 feet. (3) North corner of lowest granite gage set by same company; elevation, 7.11 feet. All elevations refer to the datum of the gage. The initial point for soundings is at the top of the face of the right abutment on the upstream side. The channel is straight for 1,000 feet above and below the bridge, and is about 180 feet wide at ordinary stages, broken by one pier. The banks are high and rocky. The bed is permanent; rocky in the right half and gravelly in the left. The velocity is rapid in the right and sluggish in the left half. At low water the measurements of flow through the left channel are made by wading. The lowest observed mean velocity is one foot per second. The gage is read twice daily by Frank Morton.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Pemigewasset River at Plymouth, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 5	N. C. Grover	1.85	270
September 22	H. K. Barrows	1.74	238
October 9	N. C. Grover	1.98	285

Mean daily gage height, in feet, of Pemigewasset River at Plymouth, N. H., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		1.75	2.20	1.80	17	1.42	1.88	2.02	2.40
2		1.62	2.10	1.75	18	1.72	3.65	2.42	2.22
3		1.52	2.10	1.70	19	2.10	3.65	2.60	2.28
4	1.90	1.45	2.05	1.72	20	2.00	2.78	2.45	2.90
5	1.92	1.62	2.00	1.70	21	1.82	2.58	2.10	6.40
6	1.90	1.78	2.35	1.75	22	1.72	2.48	2.10	7.18
7	2.02	1.98	2.52	1.78	23	1.65	2.30	2.05	6.52
8	2.05	1.82	2.35	1.80	24	1.62	2.38	2.15	6.48
9	1.90	2.20	2.15	1.75	25	1.58	2.30	2.38	6.32
10	1.90	2.78	2.05	1.80	26	1.52	2.12	2.30	6.00
11	1.78	2.40	2.10	1.82	27	1.45	2.15	1.90	5.90
12	1.82	2.20	2.00	1.80	28	1.50	2.05	1.78	5.80
13	1.60	2.10	1.98	1.90	29	1.82	1.95	1.70	5.65
14	1.62	2.10	1.90	2.42	30	1.78	2.10	1.80	5.40
15	1.60	2.00	1.95	2.55	31		2.10		5.20
16	1.52	1.88	1.90	2.48					

CONTOOCOOK RIVER AT WEST HOPKINTON, N. H.

This station was established July 9, 1903, by H. K. Barrows. It is located at the wooden highway bridge near the railway station at West Hopkinton. The drainage area at this point is 410 square miles. A standard chain gage is attached to the downstream side of the board covering of the bridge; length of chain, 26.11 feet. It is referred to a bench mark on the highest point of the large rock on the south side of the road, 15 feet northwest of left abutment; elevation, 21.55 feet above gage datum. The initial point for soundings is at the downstream side of the right abutment at the top. The channel is straight for 300 feet above and 500 feet below the station, and is about 125 feet wide at ordinary stages. The banks are high and rocky and not subject to overflow. The bed is rough and rocky, but permanent. The current is rapid; the lowest observed mean velocity is 1.27 feet per second, at gage height 2.42 feet. The gage is read twice daily by Frank H. Carr.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Contoocook River at West Hopkinton, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 9	H. K. Barrows	3.00	372
July 14	N. C. Grover	2.93	340
July 30	H. K. Barrows	2.84	305
September 8	do	2.58	220
October 7	N. C. Grover	2.42	153

Mean daily gage height, in feet, of Contoocook River at West Hopkinton, N. H., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.15	3.05	2.58	2.78	17	2.90	2.70	2.55	3.08	3.02
2	.....	2.95	3.02	2.52	2.78	18	2.85	2.58	2.62	3.30	3.55
3	.....	2.82	2.95	2.58	2.82	19	2.90	2.68	2.82	3.52	3.88
4	.....	2.78	2.85	2.48	2.85	20	2.95	2.78	2.72	3.45	3.55
5	.....	2.98	2.82	2.55	2.90	21	3.25	2.98	2.72	3.22	3.10
6	.....	3.28	2.75	2.48	2.95	22	3.85	2.88	2.60	3.05	2.98
7	.....	3.35	2.82	2.45	2.92	23	3.95	2.82	2.55	3.05	3.00
8	3.00	3.15	2.65	2.48	2.88	24	3.85	2.75	2.60	3.05	2.98
9	2.95	3.05	2.62	3.00	2.85	25	3.65	2.70	2.52	3.10	3.10
10	2.92	2.95	2.62	3.85	2.80	26	3.20	3.35	2.48	3.02	(a)
11	.....	2.80	2.50	3.90	2.82	27	3.00	3.40	2.42	2.92	.....
12	2.99	2.92	2.48	3.70	2.82	28	2.90	3.15	2.55	2.88	.....
13	2.95	2.88	2.42	3.95	2.82	29	2.90	2.95	2.52	2.90	.....
14	2.80	2.82	2.65	3.85	2.78	30	3.05	2.92	2.62	2.82	.....
15	2.90	2.78	2.48	3.52	2.70	31	3.28	3.02	.....	2.80	.....
16	2.85	2.70	2.45	3.30	2.68						

a Frozen November 26 to December 31.

SUDBURY RIVER AT FRAMINGHAM, AND LAKE COCHITUATE AT COCHITUATE, MASS.

Sudbury River, a small stream of eastern Massachusetts, receives water from an area west of Framingham. It flows thence in a northerly course through meadows and swamps and joins Assabet River to form Concord River, which in turn continues northerly, entering Merrimac River immediately below the city of Lowell. Storage reservoirs have been constructed by the city of Boston and the Metropolitan Water Board, controlling the greater part of the flow from this basin.

Lake Cochituate drains into Sudbury River a short distance below Framingham. It is controlled as a storage reservoir by the Metropolitan Water Works.

Sudbury River and Lake Cochituate have been studied by the engineers of the city of Boston, the State board of health of Massachusetts, and the Metropolitan Water Board, and records of rainfall in the Sudbury basin have been kept since 1875, and in the Cochituate basin since 1852, but the latter are considered of doubtful accuracy previous to 1872. The records of run-off from 1875 to 1898, inclusive, for Sudbury River, were published in the Twentieth Annual Report, Part IV, and those for Lake Cochituate from 1863 to 1899, inclusive, in Water-Supply and Irrigation Paper No. 35.

The following tables, furnished by Frederic P. Stearns, give the results for 1903; also the averages for twenty-nine years for Sudbury River, and for forty-one years for Lake Cochituate.

Estimated monthly run-off of Sudbury River basin at Framingham, Mass.

[Drainage area, 75.2 square miles.]

Month.	Run-off.		Rainfall in inches.
	Second-feet per square mile.	Depth in inches.	
1903.			
January	2.685	3.096	3.80
February	3.526	3.672	3.95
March	5.344	6.151	6.63
April	3.498	3.903	2.99
May	.542	.625	.93
June	3.075	3.431	9.25
July	.689	.794	2.77
August	.475	.547	3.67
September	.201	.225	1.75
October	.761	.877	4.72
November	.561	.626	1.56
December	.901	1.038	3.14
The year	1.841	24.995	45.16
1875–1903.			
January	1.922	2.216	4.18
February	2.933	3.076	4.39
March	4.620	5.326	4.66
April	3.212	3.582	3.43
May	1.734	1.999	3.37
June	.813	.907	3.10
July	.306	.353	3.73
August	.456	.526	4.06
September	.360	.402	3.23
October	.800	.922	4.31
November	1.375	1.534	4.03
December	1.718	1.981	3.85
Average	1.680	22.824	46.34

Estimated monthly run-off of Lake Cochituate basin at Cochituate, Mass.

[Drainage area, 18.87 square miles.]

Month.	Run-off.		Rainfall in inches.
	Second-feet per square mile.	Depth in inches.	
1903.			
January	2.184	2.52	3.81
February	2.734	2.85	3.88
March	4.311	4.97	6.30
April	3.106	3.46	3.17
May	.689	.79	1.56
June	2.132	2.38	7.61
July	.553	.64	3.00
August	.408	.47	4.20
September	.130	.14	1.31
October	.886	1.02	4.27
November	.534	.60	1.53
December	.815	.94	3.18
The year	1.531	20.78	43.82
1863–1903.			
January	1.760	2.03	3.92
February	2.516	2.64	4.06
March	3.439	3.97	4.49
April	2.640	2.94	3.58
May	1.531	1.77	3.77
June	.730	.81	3.02
July	.471	.54	4.19
August	.666	.77	4.43
September	.647	.72	3.43
October	.914	1.05	4.47
November	1.280	1.43	4.22
December	1.509	1.74	3.57
Average	1.503	20.41	47.15

SOUTH BRANCH OF NASHUA RIVER AT CLINTON, MASS.

Since July, 1896, the flow of the South Branch of Nashua River has been measured at Clinton by the engineers of the Metropolitan Water Board. The results of these measurements have been furnished by Frederic P. Stearns, chief engineer. A large storage reservoir is now being constructed at Clinton, Mass. Water was stored to an appre-

ciable extent in this reservoir during 1903. Beginning with 1897 the flow has been corrected for loss and gain of storage in ponds and mill reservoirs on the watershed, so that the results show the natural flow of the stream. The following tables give the results for 1903, also the average for the years 1897–1903, inclusive:

Estimated monthly run-off of South Branch Nashua River basin at Clinton, Mass.

[Drainage area, 119 square miles.]

Month.	Run-off.		Rainfall in inches.
	Second-feet per square mile.	Depth in inches.	
1903.			
January	1.957	2.256	2.85
February	3.300	3.436	4.42
March	5.297	6.107	6.58
April	3.463	3.864	3.10
May	.880	1.015	1.24
June	3.297	3.678	10.37
July	.966	1.114	3.43
August	.734	.846	2.88
September	.580	.647	2.93
October	1.065	1.228	4.43
November	.981	1.095	2.36
December	1.476	1.702	3.99
The year 1903	1.988	26.988	49.58
1897–1903.			
January	1.924	2.218	3.56
February	2.564	2.670	4.35
March	4.969	5.729	5.27
April	3.977	4.438	4.08
May	2.017	2.325	3.51
June	1.475	1.646	4.53
July	.826	.953	4.52
August	.870	1.003	4.70
September	.523	.584	3.28
October	1.009	1.163	4.04
November	1.446	1.614	4.07
December	2.719	3.135	5.16
Average	2.024	27.478	51.07

CONNECTICUT RIVER DRAINAGE BASIN.

Connecticut River has its source in Connecticut Lake, in northern New Hampshire. Its extreme headwaters, however, lie in the province of Quebec and in the mountains on the northern boundary of New Hampshire; thence the river flows in a southerly direction between New Hampshire and Vermont and through Massachusetts and Connecticut into Long Island Sound. The total drainage area is 11,085 square miles, of which 155 square miles lie in the province of Quebec. Its total length from Connecticut Lake to Long Island Sound is 345 miles. On its banks are many cities and towns of importance. It is in general closely followed by one or more railroad lines. Water power is used at several points, notably at Windsor Locks in Connecticut, Holyoke and Turners Falls in Massachusetts, and Bellows Falls and Wilder in Vermont. The valley of Connecticut River proper is very generally in farm lands. Many of its tributary basins, however, especially in the northern portions, are heavily wooded.

Estimates of the flow of this river at Hartford, Conn., from 1871 to 1885, inclusive, have been published in the Fourteenth Annual Report of the United States Geological Survey, Part II, pages 140–146. Estimates of flow at Holyoke, Mass., from 1880 to 1895, inclusive, have been published in Bulletin No. 140, pages 37–41, and for 1896 and 1897 in the Nineteenth Annual Report, Part IV, page 116. The drainage areas of the river and of several of its tributaries are given in the following table:

Drainage area of Connecticut River and tributaries.

River.	Locality.	Area.
		Square miles.
Connecticut	Mouth	11,085
Do	Hartford, Conn	10,235
Do	Orford, N. H	3,305
Do	In Canada	155
Ashuelot	Winchester, N. H	385
White	Sharon, Vt	680
Ammonoosuc	Bretton Woods, N. H	34
Zealand	Mouth	14
Israel	Below South Branch	21.2
Do	Above South Branch	8.7
Passumpsic	St. Johnsbury Center, Vt	390

The United States Geological Survey maintains gaging stations in this basin on Connecticut River at Orford, N. H.; on Israel River at

Jefferson Highlands, N. H.; on Passumpsic River at St. Johnsbury Center, Vt.; on Ammonoosuc River at Bretton Woods, N. H.; on Zealand River at Twin Mountain, N. H.; on White River at Sharon, Vt., and on Ashuelot River at Winchester, N. H.

CONNECTICUT RIVER AT ORFORD, N. H.

This station was established August 6, 1900, by E. G. Paul. It is located at the wooden highway bridge between Orford, N. H., and Fairlee, Vt., and is about 75 miles from the source of the stream. The drainage area at this point is 3,305 square miles. A standard chain gage is attached to the inside timbers of the upper side of the bridge, 125 feet from the left abutment; length of chain, 42.95 feet. It is referred to bench marks as follows: (1) Top of downstream corner of right abutment at face; elevation, 30.34 feet. (2) Top of downstream corner of left abutment at face; elevation, 31.08 feet. (3) Nail in root of elm tree on Orford side, 28.4 feet from southwest corner of bridge and 11.6 feet from produced line of downstream side of bridge; elevation, 40.11 feet. Elevations are above gage datum. The channel is straight for at least 1,000 feet above and 1,000 feet below the station, is about 275 feet wide at ordinary stages of the river, and is broken by one pier. The bed is of gravel and permanent, while the current is strong. The gage is read once daily by Frank H. Gardner, of Orford, N. H.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Connecticut River at Orford, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 24	Chas. A. Holden	[a] 6.00	2,968
January 29	do	[a] 5.40	2,621
Do	do	[a] 5.50	2,689
January 30	do	[a] 6.00	2,979
February 7	do	[a] 6.05	2,994
Do	do	[a] 6.05	3,033
March 14	do	20.70	[b] 24,740
April 23	do	8.25	6,221
June 2	E. C. Murphy	3.26	1,171
July 16	N. C. Grover	3.53	1,517
August 29	Chas. A. Holden	4.55	2,146
September 19	do	2.30	768
September 26	do	2.13	673

[a] Through ice; gage height is to bottom of ice. [b] Estimated.

Mean daily gage height, in feet, of Connecticut River at Orford, N. H., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 7.70	8.80	13.10	16.00	8.00	4.00	4.40	5.10	4.40	2.50	3.30	3.20
2	7.70	8.70	15.60	15.00	8.10	3.50	4.40	6.00	4.30	2.50	3.40	3.20
3	7.80	8.40	15.40	13.50	8.00	3.30	4.60	5.50	4.30	2.60	3.70	3.30
4	7.80	8.20	14.70	13.80	7.40	3.30	4.90	4.50	4.20	2.60	4.20	3.40
5	.....	8.20	14.00	18.20	7.10	3.10	5.00	4.20	4.20	2.60	4.10	3.40
6	7.40	8.10	13.50	16.20	6.80	3.00	4.60	3.80	4.20	2.90	4.00	3.30
7	.....	7.40	12.40	14.70	6.50	3.20	4.30	3.80	4.00	3.20	3.90	3.70
8	7.00	7.00	12.10	13.60	6.50	3.40	4.10	3.70	3.40	3.30	4.50	3.70
9	.....	7.00	15.50	14.40	6.60	3.50	3.70	3.70	3.10	3.30	4.40	3.60
10	.....	7.10	19.10	14.40	6.80	3.80	3.50	3.70	3.00	3.40	4.20	3.60
11	6.90	7.30	22.40	14.20	6.90	3.60	3.70	3.90	2.80	3.20	4.10	3.70
12	.....	7.10	23.10	13.50	7.00	4.60	4.50	4.50	2.80	3.00	3.80	3.90
13	.....	7.80	22.90	12.60	6.80	7.25	5.00	4.50	2.80	2.80	3.70	3.90
14	.....	8.50	21.20	11.60	6.00	9.60	4.50	4.40	2.70	2.50	3.50	3.90
15	.....	8.40	20.30	11.50	6.20	9.60	3.90	4.30	2.70	2.60	3.30	[b]
16	6.70	8.30	19.80	11.30	5.80	8.00	3.50	4.20	2.50	2.60	3.40	.....
17	6.70	8.30	19.20	11.40	5.80	6.60	3.60	4.50	2.30	2.70	3.50	.....
18	.....	7.90	17.80	10.40	5.80	5.70	4.50	4.10	2.20	2.80	3.60	.....
19	.....	7.40	16.50	9.90	5.40	5.30	5.50	3.40	2.30	4.00	3.60	4.00
20	.....	7.40	17.50	9.80	5.00	5.30	5.50	3.30	2.30	4.20	3.40	4.10
21	6.10	7.30	20.70	9.20	5.00	5.60	4.80	3.60	2.40	4.40	3.20	5.50
22	6.60	7.30	23.20	8.60	4.90	5.90	4.80	4.70	2.30	4.00	3.40	7.00
23	7.50	7.30	25.10	8.40	4.30	8.50	4.80	5.80	2.20	3.70	3.40	6.00
24	7.30	7.30	26.10	7.90	4.50	8.00	4.90	5.70	2.10	3.80	3.50	5.80
25	6.80	7.10	26.00	7.90	4.40	7.10	5.00	5.50	2.00	4.00	3.40	5.30
26	6.70	7.00	24.70	7.90	4.00	6.00	4.90	5.10	2.10	4.30	3.30	4.90
27	6.50	7.00	22.50	7.80	3.80	5.80	5.90	4.80	2.10	4.10	3.10	4.80
28	6.30	6.80	19.60	7.70	3.70	5.00	6.50	4.90	2.20	4.00	3.00	4.70
29	6.60	.....	16.70	7.50	3.70	4.60	6.00	4.60	2.20	3.70	2.90	4.50
30	7.00	.....	14.70	7.50	3.60	4.60	5.40	4.30	2.30	3.30	3.10	4.40
31	8.00	.....	13.50	.....	3.60	.....	5.10	4.40	.....	3.30	.....	4.40

[a] January 1 to February 28 to top of ice. [b] December 15 to 31 to top of ice.

Rating table for Connecticut River at Orford, N. H., from January 1 to February 28, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.1	2,260	6.8	2,720	7.5	3,210	8.2	3,700
6.2	2,320	6.9	2,790	7.6	3,280	8.3	3,770
6.3	2,380	7.0	2,860	7.7	3,350	8.4	3,850
6.4	2,440	7.1	2,930	7.8	3,420	8.5	3,930
6.5	2,510	7.2	3,000	7.9	3,490	8.6	4,010
6.6	2,580	7.3	3,070	8.0	3,560	8.7	4,090
6.7	2,650	7.4	3,140	8.1	3,630	8.8	4,170

Table determined by six measurements through ice. Table extended below 6.55 and above 7.40. Table is only approximate.

Rating table for Connecticut River at Orford, N. H., from March 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	640	6.0	3,470	10.0	8,250	14.0	14,200
2.1	680	6.1	3,570	10.1	8,390	14.1	14,350
2.2	725	6.2	3,680	10.2	8,530	14.2	14,500
2.3	770	6.3	3,790	10.3	8,670	14.3	14,650
2.4	815	6.4	3,900	10.4	8,810	14.4	14,800
2.5	860	6.5	4,010	10.5	8,950	14.5	14,950
2.6	905	6.6	4,120	10.6	9,100	14.6	15,100
2.7	950	6.7	4,230	10.7	9,250	14.7	15,250
2.8	1,000	6.8	4,340	10.8	9,400	14.8	15,400
2.9	1,050	6.9	4,450	10.9	9,550	14.9	15,550
3.0	1,100	7.0	4,560	11.0	9,700	15.0	15,700
3.1	1,160	7.1	4,670	11.1	9,850	15.1	15,850
3.2	1,220	7.2	4,780	11.2	10,000	15.2	16,000
3.3	1,280	7.3	4,890	11.3	10,150	15.3	16,150
3.4	1,340	7.4	5,000	11.4	10,300	15.4	16,300
3.5	1,400	7.5	5,110	11.5	10,450	15.5	16,450
3.6	1,460	7.6	5,220	11.6	10,600	15.6	16,600
3.7	1,530	7.7	5,330	11.7	10,750	15.7	16,750
3.8	1,600	7.8	5,440	11.8	10,900	15.8	16,900
3.9	1,670	7.9	5,550	11.9	11,050	15.9	17,050
4.0	1,740	8.0	5,660	12.0	11,200	16.0	17,200
4.1	1,810	8.1	5,780	12.1	11,350	16.1	17,350
4.2	1,880	8.2	5,900	12.2	11,500	16.2	17,500
4.3	1,950	8.3	6,020	12.3	11,650	16.3	17,650
4.4	2,030	8.4	6,140	12.4	11,800	16.4	17,800
4.5	2,110	8.5	6,260	12.5	11,950	16.5	17,950
4.6	2,190	8.6	6,380	12.6	12,100	16.6	18,100
4.7	2,270	8.7	6,510	12.7	12,250	16.7	18,250
4.8	2,350	8.8	6,640	12.8	12,400	16.8	18,400
4.9	2,430	8.9	6,770	12.9	12,550	16.9	18,550
5.0	2,520	9.0	6,900	13.0	12,700	17.0	18,700
5.1	2,610	9.1	7,030	13.1	12,850	17.1	18,850
5.2	2,700	9.2	7,160	13.2	13,000	17.2	19,000
5.3	2,790	9.3	7,290	13.3	13,150	17.3	19,150
5.4	2,880	9.4	7,420	13.4	13,300	17.4	19,300
5.5	2,970	9.5	7,550	13.5	13,450	17.5	19,450
5.6	3,070	9.6	7,690	13.6	13,600	17.6	19,600
5.7	3,170	9.7	7,830	13.7	13,750	17.7	19,750
5.8	3,270	9.8	7,970	13.8	13,900	17.8	19,900
5.9	3,370	9.9	8,110	13.9	14,050	17.9	20,050

Rating table for Connecticut River at Orford, N. H., etc.—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
18.0	20,200	19.8	22,900	22.4	26,800	24.7	30,250
18.1	20,350	20.0	23,200	22.5	26,950	25.0	30,700
18.2	20,500	20.3	23,650	22.9	27,550	26.0	32,200
19.0	21,700	20.7	24,250	23.0	27,700	26.1	32,350
19.1	21,850	21.0	24,700	23.1	27,850	27.0	33,700
19.2	22,000	21.2	25,000	23.2	28,000	28.0	35,200
19.6	22,600	22.0	26,200	24.0	29,200	28.1	35,350

Table well determined to 12.00 feet gage height. Table determined by two estimated flood measurements above 12.00 feet gage height.

Estimated monthly discharge of Connecticut River at Orford, N. H., for 1903.

[Drainage average, 3,050 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January			2,900	0.95	0.71
February	4,170	2,720	3,325	1.09	1.13
March	32,350	11,350	21,211	6.95	8.01
April	20,500	5,110	10,659	3.49	3.89
May	5,780	1,460	3,344	1.10	1.27
June	7,690	1,100	3,086	1.01	1.13
July	4,010	1,400	2,313	.76	.88
August	3,470	1,280	2,123	.70	.81
September	2,030	640	1,097	.36	.40
October	2,030	860	1,303	.43	.50
November	2,110	1,050	1,476	.48	.54
December			2,001	.66	.66

CONNECTICUT RIVER AT HARTFORD, CONN.

Daily readings of the height of water at Hartford have been recorded since February 8, 1896, by Edwin Dwight Graves, chief engineer Connecticut River bridge and highway district, and through his courtesy have been furnished to the United States Geological Survey.

These heights are read on what is known as the "Tollhouse gage," the zero of which is set at the low-water mark of 1801.[a] The highest water ever known in the river was in May, 1854—29 feet 10 inches; the lowest, in 1858—1½ inches below zero.

[a] See report Theodore G. Ellis, 1867 (Ex. Doc. H. R. No. 153, 40th Cong., 2d sess.).

This datum was used in the various surveys of the river below Hartford in 1866–67 (see previous reference); also the survey above Hartford in 1871–1878;[a] also survey of 1897.[b] It is now being used in a further survey of the river above Hartford by an engineer commission appointed by the Secretary of War to study the problem of river improvements above Hartford.

During the low-water periods the tidal wave comes up the river to Hartford. The visible effect of this wave is dependent upon the height of the water and the direction and course of the wind.

From figures given in the Report of the Chief of Engineers for 1878, pages 348–391, and from other data, computations of the discharge of Connecticut River at Hartford from 1871 to 1886, inclusive, were prepared and published in the Fourteenth Annual Report of the United States Geological Survey, Part II, pages 140–146.

Mean daily gage height, in feet, of Connecticut River at Hartford, Conn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.5	8.3	11.9	14.5	5.3	1.9	5.8	3.4	5.2	2.2	2.5	3.0
2	6.1	8.9	14.3	14.7	4.9	2.5	5.3	3.0	4.4	2.5	2.7	3.1
3	6.3	9.3	16.6	14.2	4.9	2.4	4.5	3.0	3.6	3.0	3.4	3.6
4	7.2	9.4	14.7	13.6	5.1	2.5	4.0	3.2	3.3	2.5	2.8	3.0
5	8.4	11.0	12.6	13.5	5.1	2.5	3.8	4.2	3.0	2.1	2.1	2.4
6	8.5	10.4	11.4	13.5	5.0	2.5	3.3	6.0	2.5	2.0	2.4	1.7
7	7.8	9.1	10.5	13.1	4.9	2.0	3.7	6.1	3.3	2.3	2.3	1.5
8	7.3	7.8	10.1	12.8	4.5	1.9	3.5	5.0	2.2	2.4	1.0	2.5
9	6.7	7.0	13.7	14.4	4.2	2.1	3.0	4.0	2.5	3.0	1.8	2.4
10	8.5	6.0	18.0	15.0	4.0	2.0	3.0	3.5	2.2	5.9	2.8	3.4
11	8.6	6.0	19.5	14.4	3.9	2.0	2.7	3.0	2.2	6.1	2.8	2.8
12	9.2	7.3	21.7	13.1	4.0	2.5	2.5	2.9	2.0	5.2	2.8	2.8
13	8.9	8.7	22.8	12.0	3.7	6.6	2.7	2.5	1.7	4.9	3.1	3.6
14	8.7	9.1	22.4	11.0	3.7	8.0	2.6	2.6	1.6	4.5	3.3	4.0
15	8.5	8.8	21.1	10.4	3.6	8.0	2.5	3.0	2.2	4.0	2.5	4.4
16	8.7	8.4	19.6	10.6	3.5	11.6	2.3	3.0	2.6	4.0	2.6	4.3
17	8.5	8.0	18.2	10.5	3.1	11.7	2.4	3.0	3.8	4.1	3.7	4.2
18	7.7	7.5	16.8	10.1	3.1	9.3	2.5	2.9	3.6	3.7	4.9	4.1
19	7.0	10.5	15.8	9.5	3.3	7.0	3.2	3.1	3.4	3.8	4.9	4.2
20	7.0	10.8	15.0	8.7	3.1	5.8	3.3	3.5	2.7	3.9	4.2	3.3
21	6.9	10.4	15.2	8.2	2.9	6.9	3.5	3.0	2.5	3.4	3.6	6.6
22	8.3	9.5	17.1	7.7	3.0	16.4	3.8	2.7	2.5	3.2	2.8	9.5
23	8.7	9.1	19.3	7.1	3.0	16.8	4.3	2.1	2.2	3.3	2.9	8.2
24	8.0	8.7	21.8	6.9	2.7	14.0	5.0	2.3	2.2	3.0	3.4	7.5
25	7.3	8.2	23.4	6.5	2.5	11.0	4.5	2.5	2.0	2.9	2.6	6.4
26	7.2	7.5	23.2	5.9	2.6	9.2	4.0	2.8	2.0	3.2	2.5	5.6
27	7.0	7.0	21.5	5.9	2.2	8.0	3.2	3.7	1.9	2.7	2.6	5.9
28	6.7	7.2	19.4	5.7	2.2	6.9	2.9	3.7	1.6	2.9	3.0	6.0
29	6.8	.....	17.3	5.5	2.1	5.8	2.9	4.1	2.0	2.9	2.9	5.7
30	7.2	.....	15.6	5.3	2.4	5.8	3.4	5.4	2.3	2.5	2.6	5.2
31	8.0	.....	14.4	.....	1.8	.....	3.8	5.5	.....	3.2	.....	4.8

[a] Engineer's Report, 1878, pp. 348–391.
[b] Engineer's Report, 1898, pp. 976–988.

ISRAEL RIVER (ABOVE SOUTH BRANCH) NEAR JEFFERSON HIGHLANDS, N. H.

This station was established September 2, 1903, by N. C. Grover. It is located at a small wooden highway bridge in the town of Randolph, about halfway between the railway stations of Jefferson Highlands and Bowman, and 2½ miles from either place. The drainage basin at this point has an area of 8.7 square miles. The headwaters of the river lie on the slopes of Mount Adams and Mount Jefferson, at elevations approximating 5,000 feet. The length of the river from its source to the gaging station is about 5 miles. The elevation at the gaging station is about 1,400 feet. All slopes are steep; many are precipitous. There is no pondage or artificial storage of water. The underlying rock is granite, exposed in the mountain tops. The basin is generally in heavy virgin forest.

A standard chain gage is attached to the upstream truss of the bridge; length of chain, 15.43 feet. It is referred to bench marks as follows: (1) Marked point on east end of cross timber of bridge; elevation, 8.58 feet. (2) Top of bowlder, 150 feet east of bridge, 30 feet south of river; elevation, 11.99 feet. Elevations are above datum of gage. The channel is straight for 100 feet above and 50 feet below the station, and is about 20 feet wide. The banks are subject to overflow in extreme freshet. Velocities at low water average about 0.50 of a foot per second. Low-water measurements are made by wading about 20 feet above the bridge. The bed is gravelly and permanent. The gage is read once daily by E. A. Crawford, of Jefferson Highlands.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Israel River (above South Branch) near Jefferson Highlands, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 2	H. K. Barrows	1.20	9.4
September 18	do	1.17	8.1
October 9	N. C. Grover	1.15	5.8

Mean daily gage height, in feet, of Israel River (above South Branch), near Jefferson Highlands, N. H., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	1.08	1.22	1.08	17	1.10	1.18	1.18	1.80
2	1.20	1.15	1.20	1.08	18	1.18	1.50	1.32	1.60
3	1.20	1.12	1.20	1.20	19	1.10	1.28	1.55	1.40
4	1.20	1.10	1.20	1.30	20	1.10	1.25	1.55	1.40
5	1.20	1.58	1.22	1.60	21	1.10	1.20	1.60	2.20
6	1.20	1.20	1.38	1.70	22	1.10	1.20	1.60	2.40
7	1.20	1.15	1.32	1.70	23	1.10	1.20	1.32	2.50
8	1.10	1.15	1.20	1.60	24	1.10	1.30	1.12	2.50
9	1.10	1.20	1.08	1.50	25	1.10	1.25	1.62	2.40
10	1.10	1.15	1.08	1.30	26	1.08	1.20	1.40	2.00
11	1.10	1.10	1.10	1.20	27	1.08	1.15	1.30	2.00
12	1.10	1.10	1.20	1.20	28	1.15	1.15	1.35	1.10
13	1.10	1.20	1.20	1.40	29	1.10	1.18	1.38	1.40
14	1.10	1.20	1.18	2.20	30	1.10	1.25	1.08	1.40
15	1.10	1.20	1.18	2.20	31	.....	1.22	.....	1.20
16	1.10	1.18	1.18	2.00					

ISRAEL RIVER (BELOW SOUTH BRANCH) NEAR JEFFERSON HIGHLANDS, N. H.

This station was established September 2, 1903, by N. C. Grover. It is located at a small wooden highway bridge about 2 miles from the railway station at Jefferson Highlands, in the town of Jefferson. The drainage basin at this point is 21.2 square miles. South Branch of Israel River has its mouth above this station, and below the station previously described. South Branch drains an area of 10.5 square miles; its headwaters are on the slopes of Mount Jefferson and Mount Dartmouth at elevations of 3,000 to 5,000 feet. The extreme length from its source to its mouth is about 5 miles. The elevation at its mouth is about 1,350 feet. As all the slopes are steep, there is little or no storage of water. The underlying rock is granite, exposed in the mountain peaks. The basin has been generally "hard cut," as the lumbermen say, but has not been burned.

A standard chain gage is attached to the downstream side of the truss of the bridge; length of chain, 12.99 feet. It is referred to bench marks as follows: (1) Marked point on center cross timber of bridge; elevation, 8.14 feet. (2) Top of bowlder 50 feet north of bridge, 15 feet west of highway; elevation, 5.20 feet. Elevations are above datum of gage. The channel is straight for 100 feet above and 100 feet below the station, and is about 20 feet wide. The bed is rough and rocky, but permanent. The banks are subject to overflow in extreme freshets. At extreme low water the mean velocity observed was 1.11 feet per second. Depths average at low water about 1 foot. Gage is read once daily by E. A. Crawford, of Jefferson Highlands.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Israel River (below South Branch) near Jefferson Highlands, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 2	H. K. Barrows	1.13	17.9
September 18	do	1.10	14.9
October 9	N. C. Grover	1.03	11.5

Mean daily gage height, in feet, of Israel River (below South Branch) near Jefferson Highlands, N. H., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		1.00	1.12	1.18	17	1.00	1.02	1.15	1.60
2	1.10	1.12	1.05	1.18	18	1.10	1.55	1.28	1.40
3	1.10	1.02	1.05	1.18	19	1.02	1.25	1.28	1.40
4	1.10	1.00	1.05	1.18	20	1.02	1.22	1.28	1.30
5	1.20	1.42	1.12	1.18	21	1.00	1.10	1.28	2.50
6	1.10	1.15	1.30	1.18	22	1.00	1.08	1.58	2.60
7	1.10	1.08	1.28	1.18	23	1.00	1.08	1.30	2.80
8	1.10	1.05	1.20	1.15	24	1.00	1.20	1.02	2.10
9	1.10	1.05	1.10	1.15	25	1.00	1.10	1.60	2.10
10	1.10	1.02	1.10	1.12	26	.98	1.08	1.92	2.70
11	1.10	1.00	1.10	1.12	27	.95	1.05	1.58	2.50
12	1.10	1.00	1.10	1.12	28	1.05	1.05	1.68	2.10
13	1.00	1.10	1.10	1.30	29	1.00	1.05	1.50	1.10
14	1.00	1.05	1.10	2.20	30	1.00	1.15	1.18	1.60
15	1.00	1.05	1.10	2.20	31		1.12		1.60
16	1.00	1.02	1.12	1.80					

PASSUMPSIC RIVER AT ST. JOHNSBURY CENTER, VT.

This station was established June 29, 1903, by H. K. Barrows. It is located at the steel highway bridge near the railway station at St. Johnsbury Center. The drainage area at this point is 390 square miles. A standard chain gage is attached to the steel truss of the downstream side of the bridge; length of chain, 21.93 feet. It is referred to bench marks as follows: (1) On the downstream end of the left abutment; elevation, 19.49 feet. (2) Marked point on the rail of the bridge near the gage box; elevation, 24.37 feet. Elevations are above datum of gage. The station was discontinued November 30, 1903, as it was found that the height and flow of water at this point were somewhat affected by the dam at St. Johnsbury.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Passumpsic River at St. Johnsbury Center, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 29	H. K. Barrows	2.57	160
July 16	N. C. Grover	2.98	249
August 4	H. K. Barrows	2.64	179
September 17	do	1.37	90

Mean daily gage height, in feet, of Passumpsic River at St. Johnsbury Center, Vt., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.70	3.32	2.58	2.12	3.00	(a)	17	.....	3.12	2.62	1.40	2.15	2.65	.....
2	.....	3.10	3.18	2.55	2.10	2.85	.....	18	.....	2.82	2.50	1.35	3.10	3.22	.....
3	.....	3.00	2.98	2.48	2.62	2.75	.....	19	.....	2.90	2.32	1.35	3.15	2.88	.....
4	.....	2.95	2.85	2.48	2.88	2.58	.....	20	.....	2.82	3.22	1.72	2.95	2.50	.....
5	.....	2.88	2.98	2.70	2.60	2.65	.....	21	.....	2.78	3.35	1.90	2.85	2.50	.....
6	.....	3.02	2.90	2.82	2.95	3.20	.....	22	.....	2.65	3.05	2.18	2.42	2.60	.....
7	.....	3.08	2.90	2.50	2.65	3.02	.....	23	.....	2.95	2.95	1.88	2.80	2.68	.....
8	.....	2.65	2.80	2.15	2.48	3.05	.....	24	.....	3.20	2.58	1.65	3.30	2.65	.....
9	.....	2.40	2.82	1.89	2.45	2.88	.....	25	.....	2.95	2.55	1.42	3.10	2.65	.....
10	.....	3.02	2.60	1.78	2.50	2.80	.....	26	.....	5.05	3.20	1.25	2.90	2.95	.....
11	.....	3.10	1.92	1.52	2.88	2.82	.....	27	.....	3.78	2.92	1.30	2.70	2.78	.....
12	.....	2.90	2.00	1.40	2.30	2.80	.....	28	.....	3.25	2.52	1.60	2.85	2.78	.....
13	.....	2.32	1.90	1.30	2.22	2.80	.....	29	.....	3.20	2.78	2.32	2.68	2.90	.....
14	.....	2.30	1.85	1.35	2.20	2.68	.....	30	2.65	3.38	2.85	2.22	2.70	2.35	.....
15	.....	2.45	2.45	1.40	2.20	2.95	.....	31	.....	3.98	2.92	.....	2.78	.....	.....
16	.....	3.02	2.85	1.52	2.15	2.90	.....								

[a] Station discontinued December 1.

AMMONOOSUC RIVER AT BRETTON WOODS, N. H.

This station was established August 28, 1903, by N. C. Grover. It is located at the steel highway bridge near Mount Pleasant House at Bretton Woods. The drainage area at this point is 34 square miles. The headwaters of the river come from the westerly slopes of Mount Jefferson and Mount Washington and the lesser peaks of the White Mountains lying to the south. The underlying rock is granite, which is exposed at points in the river bed and on the various mountain summits. The slopes and valleys are usually well forested, with a preponderance of evergreen growth. The area was cut in large part for spruce several years ago, but now has a thick forest cover. There is no pondage or artificial storage. The slope of the river is steep.

A standard chain gage is attached to the floor on the downstream side of the bridge; length of chain, 18.86 feet. It is referred to the following-described bench marks: (1) Marked point on bridge near gage; elevation, 17.36 feet. (2) Northwest corner of east abutment; elevation, 14.46 feet. (3) Top of bowlder 100 feet below bridge, between the river and tracks of Boston and Maine Railroad; elevation,

17.11 feet. Elevations are above datum of gage. Measurements of flow are made from a footbridge located about 300 feet downstream from the gage. The channel is straight for 300 feet above and 200 feet below this bridge, and is about 35 feet wide. The banks are high and not subject to overflow except in extreme freshet. The bed is somewhat rocky, but permanent. Low-water measurements are made by wading about 100 feet above the station, on account of small velocity at the station.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Ammonoosuc River at Bretton Woods, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 28	H. K. Barrows	1.65	45
October 10	N. C. Grover	1.64	40
September 2	H. K. Barrows	1.50	31
September 3	do	1.48	29
September 17	do	1.26	15
Do	do	1.26	16

Mean daily gage height, in feet, of Ammonoosuc River at Bretton Woods, N. H., in 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.55	1.35	1.70	1.30	17		1.28	1.45	1.50	
2		1.55	1.42	1.62	1.30	18		1.55	2.60	1.68	
3		1.48	1.38	1.58	1.30	19		1.40	1.95	1.65	1.50
4		1.42	1.35	1.50	1.35	20		1.38	1.75	1.60	
5		1.52	1.52	1.58	1.35	21		1.35	1.60	1.55	2.82
6		1.48	1.52	2.05	1.35	22		1.32	1.60	1.50	2.62
7		1.44	1.45	1.55	1.35	23		1.30	1.68	1.50	2.22
8		1.44	1.48	1.55	1.35	24		1.30	1.78	1.48	1.78
9		1.40	1.65	1.55	1.35	25		1.30	1.65	1.45	1.60
10		1.40	1.70	1.55	1.40	26		1.30	1.65	1.40	1.60
11		1.40	1.65	1.50	1.40	27		1.30	1.60	1.40	1.65
12		1.32	1.60	1.50	1.35	28	1.60	1.40	1.55	1.35	1.70
13		1.32	1.52	1.50	1.52	29		1.38	1.55	1.30	1.65
14		1.32	1.50	1.50	2.12	30	1.52	1.35	1.60	1.32	1.60
15		1.32	1.45	1.50		31	1.55		1.65		1.60
16		1.28	1.45	1.50							

ZEALAND RIVER AT TWIN MOUNTAIN, N. H.

This gaging station was established August 29, 1903, by N. C. Grover. It is located about 800 feet above the mouth of the river, which empties into the Ammonoosuc at a point midway between Fabyans and Twin Mountain and about 2½ miles from either place. The drainage basin at this point has an area of 14 square miles. The headwaters lie on the slopes of a spur of the White Mountains at elevations of 2,500 to 3,000 feet. The length of the river from its headwaters to its mouth is

about 7 miles, at which point the elevation is approximately 1,500 feet. All slopes within the basin are steep. There is no pondage or artificial storage of water. The underlying rock is granite, which is exposed in the mountain peaks. About ten or twelve years ago this basin was entirely deforested and burned over. At the present time there is a thick stand of deciduous growth of poplar and bird cherry, averaging 12 to 15 feet in height, which affords a thick covering during the summer months, but practically no cover during the winter and spring. Within the basin we find the usual conditions of this stage of reforestation after a thorough burning.

A standard chain gage is attached to trees on the bank; length of chain, 13.40 feet. It is referred to bench marks as follows: (1) Top of large bowlder under the gage; elevation, 3.56 feet. (2) Drift bolt driven into the maple tree to which the gage is attached; elevation, 11.32 feet. Elevations are above datum of gage. The lowest observed mean velocity has been 0.40 of a foot per second. Low-water measurements are made by wading. The bed is rough and rocky, but permanent. The banks are high and only subject to overflow in extreme freshets. The gage is read once a day by William Cote, of Twin Mountain.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Zealand River at Twin Mountain, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 29	H. K. Barrows	2.01	13
September 3	do	1.98	11
September 18	do	2.22	23
October 10	N. C. Grover	2.29	27

Mean daily gage height, in feet, of Zealand River at Twin Mountain, N. H., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.00	1.90	2.20	2.20	17		2.00	2.00	2.20	2.30
2		2.00	1.90	2.20	2.15	18		2.20	2.40	2.30	2.50
3		2.00	1.90	2.30	2.10	19		2.00	2.40	2.30	2.50
4		1.90	1.90	2.20	2.20	20		2.00	2.30	2.25	2.40
5		2.20	2.00	2.20	2.20	21		2.00	2.30	2.20	2.40
6		2.00	2.00	2.20	2.30	22		1.90	2.20	2.20	2.40
7		2.00	1.95	2.20	2.30	23		1.90	2.20	2.20	2.30
8		2.00	1.95	2.30	2.25	24		1.90	2.20	2.10	2.30
9		1.90	2.00	2.30	2.20	25		1.90	2.20	2.30	2.30
10		1.90	2.00	2.20	2.30	26		1.90	2.30	2.30	2.40
11		1.90	2.00	2.20	2.40	27		1.90	2.30	2.20	2.40
12		1.90	2.00	2.20	2.40	28		2.00	2.25	2.20	2.40
13		1.90	2.00	2.30	2.30	29	2.00	2.00	2.20	2.15	(a)
14		1.90	2.00	2.30	2.25	30	2.20	1.90	2.20	2.10	
15		1.90	2.00	2.30	2.20	31	2.20		2.30		
16		1.90	2.00	2.20	2.20						

a Frozen December 29 to 31.

WHITE RIVER AT SHARON, VT.

This station was established June 30, 1903, by H. K. Barrows. It is located at the steel highway bridge near the railway station at Sharon. The drainage area at this point is 680 square miles. A standard chain gage is attached to the upstream truss of the bridge; length of chain, 27.58 feet. It is referred to bench marks as follows: (1) Marked point on post near the gage; elevation, 29.96 feet; (2) on south side of east abutment; elevation, 24.59 feet. Elevations are above datum of gage. This station is located above and within the backwater from a crib dam, which is not used for power purposes, all water, except leakage, passing over the crest of the dam. The channel is straight for 500 feet above and 500 feet below the station. It is about 170 feet wide at ordinary stages. The current is sluggish at low water. Measurements at low stages are made by wading at a point about one-half mile above the bridge, where the bed is of gravel and the current swift. The gage is read twice daily by John Fenton, of Sharon.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of White River at Sharon, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 30	H. K. Barrows	5.03	440
August 1	do	4.87	395
September 10	do	4.79	270

Mean daily gage height, in feet, of White River at Sharon, Vt., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		5.08	4.85	4.92	4.68	4.88	17		4.75	4.88	4.78	4.84	4.88
2		5.25	4.78	4.88	4.68	4.91	18		4.78	4.88	4.78	5.08	5.12
3		5.00	4.75	4.82	4.68	4.91	19		4.75	4.86	4.78	5.26	5.06
4		5.00	4.78	4.82	4.68	4.84	20		4.85	5.22	4.70	5.10	4.90
5		4.88	4.90	5.00	4.71	4.84	21		5.02	5.28	4.70	5.00	4.82
6		4.90	4.92	4.96	5.00	5.01	22		5.12	5.06	4.68	4.95	(a)
7		4.85	4.98	4.88	4.85	4.96	23		5.90	4.92	4.68	4.92	
8		4.85	4.82	4.84	4.81	4.82	24		5.28	4.88	4.66	5.09	
9		4.80	4.82	4.81	5.12	4.85	25		5.05	4.90	4.65	5.05	
10		4.75	4.78	4.78	5.36	4.92	26		5.02	5.15	4.65	5.00	
11		4.76	4.86	4.78	5.12	4.82	27		5.12	5.01	4.65	5.00	
12		4.72	6.05	4.72	5.02	4.85	28		4.98	4.94	4.70	4.96	
13		4.75	5.30	4.72	4.95	4.88	29		4.90	4.88	4.76	4.88	
14		4.70	5.10	4.75	4.88	4.85	30	5.03	5.00	4.84	4.70	4.88	
15		4.72	4.92	4.71	4.88	4.78	31		4.95	4.91		4.94	
16		4.78	4.90	4.70	4.84	4.85							

(a) Frozen November 22 to December 31.

ASHUELOT RIVER AT WINCHESTER, N. H.

This station was established July 10, 1903, by H. K. Barrows. It is located at the steel highway bridge in the village of Winchester. The drainage area at this point is 385 square miles. A standard chain gage is attached to the bottom chord of the upstream truss; length of chain, 25.24 feet. It is referred to bench marks as follows: (1) East end of left abutment; elevation, 20.79 feet. (2) Top of watering trough in the village square; elevation, 25.18 feet. Elevations are above datum of gage. The channel is straight for 300 feet above and 500 feet below the station, and is about 70 feet wide at ordinary stages, broken by one pier. The current is sluggish at low stages of the river; the lowest observed mean velocity having been 0.39 foot per second at gage height 4.02.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Ashuelot River at Winchester, N. H., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 10	H. K. Barrows	4.28	207
July 15	N. C. Grover	4.00	169
July 30	H. K. Barrows	4.12	132
August 3	do	4.48	246
September 10	do	3.94	187
October 7	N. C. Grover	4.02	105

Mean daily gage height, in feet, of Ashuelot River at Winchester, N. H., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1		4.60	4.52	4.05	4.28	17	3.95	4.15	3.90	4.55	4.55
2		4.50	4.55	4.15	4.30	18	4.05	4.02	4.02	4.68	4.55
3		4.40	4.40	4.00	4.20	19	4.08	4.00	4.10	5.08	5.48
4		4.25	4.30	3.92	4.22	20	4.05	3.98	4.30	4.92	5.05
5		4.35	4.28	3.60	4.15	21	4.28	4.15	4.95	4.70	4.65
6		4.60	4.22	4.32	4.20	22	4.70	4.35	4.05	4.62	4.52
7		4.52	4.32	4.10	4.05	23	4.95	4.20	4.18	4.55	4.65
8		4.45	4.08	4.05	4.35	24	4.98	4.28	4.10	4.65	4.40
9		4.30	3.90	4.48	4.52	25	4.70	4.12	3.62	4.68	4.50
10	4.38	4.42	3.95	4.48	4.20	26	4.48	4.55	3.95	4.65	4.48
11	4.32	4.12	4.02	5.02	4.15	27	4.40	4.98	4.02	4.55	4.40
12	4.25	4.20	3.95	4.98	4.05	28	4.25	4.70	4.05	4.52	4.32
13	4.18	4.28	4.12	4.82	4.05	29	4.20	4.42	4.12	4.42	(a)
14	4.15	4.35	3.75	4.85	4.12	30	4.20	4.50	4.08	4.25	
15	4.00	4.12	3.88	4.70	4.05	31	4.50	4.68		4.18	
16	4.08	4.15	3.85	4.60	4.42						

[a] Frozen November 29 to December 31.

HOUSATONIC DRAINAGE BASIN.

Housatonic River has its source in Berkshire County, Mass. It flows southerly across Massachusetts and the western end of Connecticut, entering Long Island Sound. Its course is nearly parallel to the eastern boundary of New York State, and it receives the drainage from Tenmile River in New York.

Tenmile River drains an area of diversified topography, including broad flats and marshes in the basin of Swamp River and extensive cultivated areas and sparsely timbered hills in the region of the Chestnut Range. The drainage area lies chiefly in New York State, the stream crossing the line into Connecticut one-half mile above the junction with the Housatonic. Stations have been maintained in this basin on the Housatonic River at Gaylordsville, Conn., and on Tenmile River near Dover Plains, N. Y.

HOUSATONIC RIVER AT GAYLORDSVILLE, CONN.

This station was established October 24, 1900, by E. G. Paul. The gage is located at the covered wooden highway bridge at Gaylordsville, Conn., 2 miles below the mouth of Tenmile River and 1¼ miles above the cable from which discharge measurements are made. The chain gage is fastened to the woodwork of the inside of the bridge. The length of the chain from the end of the weight to the marker is 30.45 feet. The gage is read twice each day by G. H. Munroe. On account of the poor cross section of the channel at the bridge, discharge measurements are made by means of a three-fourths-inch cable and car 1¼ miles below. The cable has a span of 200 feet. It is supported on the right bank by timbers 25 feet high, and is anchored to a large rock buried in the ground. On the left bank the cable is supported by a large sycamore tree and fastened to the base of a large oak. The initial point for soundings is the zero of the tagged wire at the sycamore tree which supports the cable on the left bank. The channel is straight for about 500 feet above and below the station. The current at the cable never becomes too sluggish to be accurately measured. At high water the current is swift and rough. Both banks are subject to overflow only at extreme freshets. Both banks have a sparse growth of trees and brush. The bed of the stream is composed of gravel and cobblestones, free from vegetation, and not subject to change. No bench mark has been established. The center of the gage pulley is 29.35 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Housatonic River at Gaylordsville, Conn., in 1900–1903.

Date.	Hydrographer.	Gage height.	Discharge.
1900.		*Feet.*	*Second-feet.*
August 9	E. G. Paul	3.30	450
August 10	do	3.25	422
October 20	do	3.10	370
October 24	do	3.00	303
1901.			
August 3	A. E. Place	3.50	549
September 13	do	4.00	912
September 28	W. W. Schlecht	3.77	701
October 29	do	4.05	951
November 13	do	4.82	1,864
November 23	do	4.11	965
December 28	do	5.16	2,520
1902.			
January 11	W. W. Schlecht	5.00	2,184
February 14[a]	do	8.30	1,111
March 4	do	9.90	13,601
March 18	do	7.63	8,259
May 3	do	6.10	4,459
June 23	do	4.46	1,177
July 11	H. K. Barrows	4.30	1,159
July 22	do	6.68	5,119
August 5	do	4.28	983
August 20	do	3.95	835
September 8	do	3.45	543
September 19	do	3.75	640
October 3	P. M. Churchill	5.35	2,133
November 15	F. H. Tillinghast	4.50	1,356
November 29	do	4.40	1,282
December 20	do	6.65	5,465
1903.			
January 23	F. H. Tillinghast	5.50	2,621
March 31	do	6.52	4,773
June 6	do	3.60	532
July 24	do	5.20	2,062
September 15	do	3.90	785

[a] Backwater from ice.

Mean daily gage height, in feet, of Housatonic River at Gaylordsville, Conn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.40	5.85	8.85	6.40	4.60	3.60	6.85	4.80	5.90	4.00	4.75	4.20
2	5.35	5.80	7.75	6.05	4.65	3.50	6.40	4.45	5.55	4.00	4.55	4.25
3	5.85	5.90	7.30	6.10	4.50	3.65	5.90	4.30	5.30	4.10	4.50	4.40
4	6.00	6.30	6.70	6.05	4.35	3.65	5.55	4.35	5.10	4.00	4.60	4.35
5	6.00	7.45	6.55	6.10	4.45	3.65	5.25	5.05	4.75	3.75	4.70	4.25
6	5.75	6.65	6.10	6.05	4.50	3.60	5.30	5.55	4.75	3.75	4.60	4.25
7	5.55	6.70	6.05	5.90	4.55	3.60	5.45	6.45	4.15	3.90	4.55	4.30
8	5.50	6.00	6.35	6.40	4.40	4.20	5.15	5.80	4.35	4.00	4.50	4.15
9	5.25	5.75	7.55	7.20	4.25	4.35	5.05	5.50	4.40	8.35	4.35	4.35
10	5.00	5.50	7.55	7.15	4.20	4.15	4.90	5.35	4.15	8.55	4.40	4.60
11	4.90	5.50	7.55	6.65	4.00	4.05	4.75	5.30	4.50	7.60	4.35	4.45
12	5.00	6.65	7.55	6.80	4.10	5.40	4.70	4.95	4.40	6.75	4.35	4.10
13	4.85	6.70	7.35	6.30	4.10	6.75	4.75	4.75	4.30	6.30	4.15	5.20
14	4.85	6.35	7.10	6.05	4.00	6.70	4.65	4.60	4.10	5.75	4.25	5.40
15	4.80	6.10	6.85	6.05	4.10	6.95	4.80	4.50	3.90	5.70	4.25	5.40
16	5.00	5.70	6.80	5.90	4.05	7.15	4.65	4.50	4.10	5.55	4.20	4.85
17	4.90	5.35	6.25	5.75	4.00	6.85	4.55	4.30	4.10	5.35	5.25	4.80
18	4.70	4.95	6.00	5.60	3.70	6.45	4.50	4.15	4.80	5.75	5.90	4.60
19	4.20	10.55	5.95	5.50	3.70	6.05	4.50	4.15	5.10	5.55	6.00	4.45
20	5.90	10.65	5.75	5.40	3.90	6.05	4.40	4.10	4.65	5.45	5.85	5.15
21	5.90	13.15	5.60	5.10	3.80	7.55	4.80	4.50	4.40	5.25	5.30	8.00
22	5.80	10.05	6.65	5.05	3.90	8.40	4.80	4.50	4.25	5.10	5.05	6.85
23	5.45	10.10	7.50	5.10	3.80	7.95	5.50	4.45	4.05	5.05	4.95	6.65
24	5.05	6.55	8.65	5.00	3.65	7.70	5.25	4.05	4.15	5.35	5.05	6.00
25	4.95	5.30	8.15	4.95	3.55	7.15	5.00	3.90	4.15	5.15	4.95	5.85
26	4.90	4.95	7.85	4.70	3.55	6.70	5.65	4.45	4.05	5.00	4.80	5.55
27	4.90	5.05	7.50	4.70	3.75	6.35	4.35	4.70	3.85	5.05	4.45	4.75
28	5.00	7.35	6.80	4.70	3.80	6.00	4.30	4.65	4.15	4.85	4.55	4.60
29	5.60	.....	6.65	4.75	4.10	5.85	4.30	5.35	4.05	4.95	4.35	4.80
30	6.15	.....	6.15	4.70	3.95	6.80	4.75	6.10	4.05	4.80	4.30	4.80
31	6.10	.....	6.55	.....	3.80	.....	5.05	6.05	.....	4.70	.....	5.05

Rating table for Housatonic River at Gaylordsville, Conn., from October 23, 1900, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	120	4.50	1,370	6.50	4,960	8.50	10,150
2.55	138	4.55	1,438	6.55	5,082	8.55	10,288
2.60	157	4.60	1,506	6.60	5,204	8.60	10,426
2.65	175	4.65	1,574	6.65	5,326	8.65	10,564
2.70	193	4.70	1,642	6.70	5,448	8.70	10,702
2.75	212	4.75	1,710	6.75	5,570	8.75	10,840
2.80	230	4.80	1,778	6.80	5,692	8.80	10,978
2.85	248	4.85	1,846	6.85	5,814	8.85	11,116
2.90	266	4.90	1,914	6.90	5,936	8.90	11,254
2.95	285	4.95	1,982	6.95	6,058	8.95	11,392
3.00	303	5.00	2,050	7.00	6,180	9.00	11,530
3.05	328	5.05	2,133	7.05	6,310	9.05	11,667
3.10	352	5.10	2,216	7.10	6,440	9.10	11,804
3.15	377	5.15	2,299	7.15	6,570	9.15	11,941
3.20	402	5.20	2,382	7.20	6,700	9.20	12,078
3.25	427	5.25	2,465	7.25	6,830	9.25	12,215
3.30	451	5.30	2,548	7.30	6,960	9.30	12,352
3.35	476	5.35	2,631	7.35	7,090	9.35	12,489
3.40	501	5.40	2,714	7.40	7,220	9.40	12,626
3.45	525	5.45	2,797	7.45	7,350	9.45	12,763
3.50	550	5.50	2,880	7.50	7,480	9.50	12,900
3.55	584	5.55	2,978	7.55	7,612	9.55	13,040
3.60	618	5.60	3,076	7.60	7,744	9.60	13,180
3.65	652	5.65	3,174	7.65	7,876	9.65	13,320
3.70	686	5.70	3,272	7.70	8,008	9.70	13,460
3.75	720	5.75	3,370	7.75	8,140	9.75	13,600
3.80	754	5.80	3,468	7.80	8,272	9.80	13,740
3.85	788	5.85	3,566	7.85	8,404	9.85	13,880
3.90	822	5.90	3,664	7.90	8,536	9.90	14,020
3.95	856	5.95	3,762	7.95	8,668	9.95	14,160
4.00	890	6.00	3,860	8.00	8,800	10.00	14,300
4.05	938	6.05	3,970	8.05	8,935	10.05	14,450
4.10	986	6.10	4,080	8.10	9,070	10.10	14,600
4.15	1,034	6.15	4,190	8.15	9,205	10.20	14,900
4.20	1,082	6.20	4,300	8.20	9,340	10.30	15,200
4.25	1,130	6.25	4,410	8.25	9,475	10.40	15,500
4.30	1,178	6.30	4,520	8.30	9,610	10.50	15,800
4.35	1,226	6.35	4,630	8.35	9,745		
4.40	1,274	6.40	4,740	8.40	9,880		
4.45	1,322	6.45	4,850	8.45	10,015		

No logarithmic extension or ice curve.

Mean daily discharge, in second-feet, of Housatonic River at Gaylordsville, Conn., for 1900–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1											402	1,914
2											352	1,506
3											352	1,178
4											266	1,082
5											303	3,076
6											266	8,468
7											230	2,714
8											402	2,216
9											550	1,914
10											986	1,370
11											822	1,082
12											686	1,082
13											618	1,082
14											686	1,082
15											686	a 1,082
16											686	a 1,082
17											618	a 1,082
18											550	a 1,178
19											618	a 1,274
20											686	a 1,370
21											986	a 1,506
22											890	a 1,642
23										266	822	1,778
24										352	822	2,216
25										402	754	1,178
26										352	1,506	1,082
27										352	2,880	986
28										352	2,714	1,082
29										352	2,216	890
30										352	1,914	822
31										303		1,082

a Estimated; river frozen.

Mean daily discharge, in second-feet, of Housatonic River, at Gaylordsville, Conn., for 1900–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	1,274	402	451	2,548	4,300	4,300	618	550	1,178	1,178	890	890
2	890	451	550	2,548	4,300	3,860	550	686	1,274	1,082	[a]1,082	986
3	[a]986	451	618	2,548	4,740	3,272	754	550	1,642	1,370	890	1,082
4	[a]1,082	451	618	4,080	4,520	2,880	822	501	1,506	1,506	754	986
5	[a]1,178	352	986	5,204	3,860	2,880	686	451	1,506	1,274	686	890
6	1,370	303	822	4,960	3,076	2,382	890	451	1,274	1,082	986	890
7	1,370	501	822	6,960	2,880	2,382	990	822	1,274	890	754	822
8	1,274	550	618	9,610	2,548	2,880	754	1,778	1,274	822	754	754
9	1,082	501	550	8,800	2,382	2,880	754	1,274	890	890	754	822
10	1,274	686	7,480	8,272	2,382	2,714	754	986	822	890	686	2,050
11	986	550	9,340	6,700	3,272	2,382	822	890	890	754	550	2,880
12	1,642	451	7,480	5,448	4,520	1,914	890	822	1,082	754	618	3,664
13	890	501	3,860	4,960	4,080	1,778	890	686	890	754	1,778	3,272
14	550	686	2,880	4,080	3,860	1,506	822	686	890	2,382	1,914	3,468
15	686	618	3,076	3,664	3,076	2,382	618	618	890	5,448	1,642	11,254
16	754	501	3,076	3,664	2,880	1,642	550	686	986	3,860	1,506	9,340
17	1,274	501	1,506	2,880	2,548	1,370	686	618	986	3,468	1,370	8,272
18	890	501	1,506	2,548	2,548	1,082	618	686	1,642	2,548	1,274	7,480
19	550	402	1,778	2,382	3,468	1,178	618	890	1,370	2,216	1,082	5,692
20	501	451	1,778	2,382	4,300	1,082	618	754	1,274	1,914	1,178	4,080
21	754	501	14,300	6,880	4,300	986	618	986	1,082	1,778	1,082	3,076
22	618	550	10,702	12,352	3,468	890	550	1,642	1,082	1,506	1,082	2,216
23	686	501	7,220	9,880	3,468	1,178	501	1,778	890	1,370	986	1,914
24	550	402	6,440	10,150	3,076	1,642	618	1,778	754	1,274	1,082	2,382
25	618	451	5,204	10,978	5,692	1,506	618	5,692	822	1,178	1,506	2,382
26	686	303	5,204	8,404	5,448	1,178	550	5,448	754	1,178	1,778	2,050
27	754	501	6,700	6,700	5,692	1,082	550	3,272	754	1,082	1,370	2,548
28	686	451	5,936	5,936	5,692	890	550	2,382	754	890	890	2,216
29	550	.....	5,204	6,180	5,936	890	550	1,778	822	890	890	4,520
30	550	.....	4,800	4,740	5,692	754	501	1,506	1,274	1,178	1,082	12,626
31	501	.....	3,468	.....	5,204	.....	686	1,274	.....	986	.....	7,744

[a] Estimated; river frozen.

Mean daily discharge, in second-feet, of Housatonic River at Gaylordsville, Conn., for 1900–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6,440	a	31,000	5,692	5,692	1,642	1,778	1,778	754	2,880	2,880	986
2	4,960	a	17,000	5,204	4,520	1,274	1,506	1,574	584	2,880	2,548	1,034
3	3,664	a	14,020	5,692	4,080	1,274	1,274	1,574	550	2,465	2,050	1,274
4	2,548	a	15,000	3,468	3,664	1,506	1,642	1,322	618	2,299	1,982	1,506
5	2,382	a	8,272	3,468	3,076	1,914	1,370	1,178	652	2,050	1,846	1,506
6	2,548	a	5,692	2,880	2,880	1,778	1,370	1,274	584	2,299	1,710	1,178
7	2,548	a	4,960	2,880	2,880	1,506	1,778	1,506	652	2,050	1,574	1,226
8	2,382	a	5,692	3,272	2,548	1,506	2,050	1,438	550	1,846	1,506	1,178
9	2,548	a	5,692	4,080	2,382	1,274	1,642	1,438	584	1,642	1,438	525
10	2,216	a	7,480	5,692	1,914	1,506	1,370	1,322	890	1,438	1,226	584
11	2,050	a	6,700	5,936	2,050	1,370	1,226	1,370	890	1,274	1,178	686
12	1,914	a	6,440	5,692	1,914	1,370	1,178	2,299	822	2,548	1,322	720
13	1,642	a	8,272	5,692	1,914	1,274	1,082	2,050	788	2,548	1,274	890
14	1,178	a	8,800	5,448	1,778	1,642	890	1,642	986	2,216	1,370	938
15	1,370	a	8,536	4,300	1,642	1,506	822	1,370	890	2,050	1,370	1,130
16	1,370	a	8,008	3,664	1,506	1,178	986	1,226	618	1,778	1,274	1,914
17	1,178	a	8,536	3,468	1,506	1,370	1,082	1,082	686	1,710	1,226	8,536
18	1,082	a	7,744	3,076	1,370	1,274	822	890	720	1,506	1,130	7,090
19	1,274	a	6,960	3,076	1,274	1,274	754	754	754	1,438	1,178	5,448
20	1,082	a	6,180	2,880	1,178	1,274	1,574	938	788	1,130	1,130	4,630
21	1,370	a	5,204	2,382	1,506	1,178	3,860	856	938	1,178	1,178	5,326
22	10,150	a	5,204	2,382	1,274	1,642	5,204	938	720	1,322	1,082	10,426
23	5,692	a	4,080	2,216	1,178	1,370	3,860	986	618	1,274	1,082	9,880
24	4,520	a	3,664	2,216	986	1,178	3,272	986	686	1,322	938	7,612
25	3,468	a	3,860	2,050	1,082	1,178	2,880	856	652	1,322	1,034	6,960
26	3,076	a	3,860	1,914	1,370	1,178	2,548	856	788	1,274	1,130	5,936
27	3,664	a	3,664	2,050	1,506	1,082	1,982	856	1,082	1,178	1,506	5,326
28	3,272	a	3,664	2,216	2,548	1,082	1,846	856	1,506	8,566	1,370	3,860
29	2,548	.....	5,448	2,216	2,548	986	2,978	822	4,520	5,082	1,274	3,370
30	1,914	.....	5,448	4,800	2,050	1,178	2,797	822	3,860	3,860	1,130	3,664
31	1,914	.....	5,448	.....	1,642	.....	2,714	686	.....	3,468	.....	3,076

a Temporary ice obstruction.

Mean daily discharge, in second-feet, of Housatonic River at Gaylordsville, Conn., for 1900–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	2,714	3,566	11,116	4,740	1,506	618	5,814	1,778	3,664	890	1,710	1,080
2	2,631	3,468	8,140	3,970	1,574	550	4,740	1,322	2,978	890	1,440	1,130
3	3,566	3,664	6,960	4,080	1,370	652	3,664	1,178	2,548	986	1,370	1,270
4	3,860	4,520	5,448	3,970	1,226	652	2,978	1,226	2,216	890	1,510	1,230
5	3,860	7,350	5,082	4,080	1,322	652	2,465	2,133	1,710	720	1,640	1,130
6	3,370	5,326	4,080	3,970	1,370	618	2,548	2,978	1,710	720	1,510	1,130
7	2,978	5,448	3,970	3,664	1,438	618	2,797	4,850	1,034	822	1,440	1,180
8	2,880	3,860	4,630	4,740	1,274	1,082	2,299	3,468	1,226	890	1,370	1,080
9	2,465	3,370	7,612	6,700	1,130	1,226	2,133	2,880	1,274	9,745	1,230	1,230
10	2,050	2,880	7,612	6,570	1,082	1,034	1,914	2,631	1,034	10,288	1,270	1,510
11	1,914	2,880	7,612	5,326	890	988	1,710	2,548	1,370	7,744	1,230	1,320
12	2,050	5,326	7,612	5,692	986	2,714	1,642	1,982	1,274	5,570	1,230	986
13	1,846	5,448	7,090	4,520	986	5,570	1,710	1,710	1,178	4,520	1,030	2,380
14	1,846	4,630	6,440	3,970	890	5,448	1,574	1,506	986	3,370	1,130	2,710
15	1,778	4,080	5,814	3,970	986	6,058	1,778	1,370	822	3,272	1,130	2,220
16	2,050	3,272	5,692	3,664	938	6,570	1,574	1,370	986	2,978	1,080	1,850
17	1,914	2,631	4,410	3,370	890	5,814	1,438	1,178	986	2,631	2,460	1,780
18	1,642	1,982	3,860	3,076	686	4,850	1,370	1,034	1,778	3,370	3,660	1,510
19	1,082[a]	16,100[a]	3,762	2,880	686	3,970	1,370	1,034	2,216	2,978	3,860	1,320
20	3,664[a]	16,400	3,370	2,714	822	3,970	1,274	986	1,574	2,797	3,570	2,300
21	3,664[a]	25,700[b]	3,076	2,216	754	7,612	1,778	1,370	1,274	2,465	2,550	8,800
22	3,468	14,450	5,326	2,133	822	9,880	1,778	1,370	1,130	2,216	2,130	5,810
23	2,797	14,600	7,480	2,216	754	8,668	2,880	1,322	938	2,133	1,980	5,330
24	2,133	5,082	10,564	2,050	652	8,008	2,465	938	1,034	2,631	2,130	3,860
25	1,982	2,548	9,205	1,982	584	6,570	2,050	822	1,034	2,299	1,980	3,570
26	1,914	1,982	8,404	1,642	584	5,448	3,174	1,322	938	2,050	1,780	2,980
27	1,914	2,133	7,480	1,642	720	4,630	1,226	1,642	788	2,133	1,320	1,710
28	2,050	7,090	5,692	1,642	754	3,860	1,178	1,574	1,034	1,846	1,440	1,510
29	3,076	.....	5,326	1,710	986	3,566	1,178	2,631	938	1,982	1,230	1,780
30	4,190	.....	4,190	1,642	856	5,692	1,710	4,080	938	1,778	1,180	1,780
31	4,080	.....	5,082	.....	754	.....	2,133	3,970	.....	1,642	.....	2,130

[a] Approximate; river obstructed by ice January 19 to 21 and February 19 to 24, 1903.
[b] Approximate; above upper limit of rating table.

Estimated monthly discharge of Housatonic River at Gaylordsville, Conn., for 1900–1903.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1900.					
November	2,880	230	876	0.858	0.96
December	3,468	822	1,560	1.529	1.76
1901.					
January	1,642	501	865	.848	.98
February	686	303	481	.471	.49
March	14,300	451	4,015	3.935	4.54
April	12,352	2,382	5,880	5.762	6.43
May	5,936	2,382	3,974	3.895	4.50
June	4,300	754	1,925	1.887	2.11
July	890	501	674	.661	.76
August	5,692	451	1,385	1.357	1.57
September	1,642	754	1,084	1.062	1.18
October	5,448	754	1,561	1.530	1.76
November	1,914	550	1,097	1.075	1.20
December	12,626	754	3,653	3.580	4.13
The year	14,300	303	2,216	.....	29.65
1902.					
January	10,150	1,082	2,838	2.781	3.21
February	[a].....	[a].....	[a].....	[a].....	[a]
March	31,000	3,664	7,759	7.604	8.77
April	5,936	1,914	3,650	3.577	3.99
May	5,692	986	2,176	2.132	2.46
June	1,914	986	1,359	1.332	1.48
July	5,204	754	1,940	1.901	2.19
August	2,299	686	1,211	1.187	1.37
September	4,520	550	991	.971	1.08
October	5,082	1,130	2,093	2.051	2.36
November	2,880	938	1,431	1.402	1.56
December	10,426	525	3,497	3.427	3.94
The year	31,000	525	2,920	2.861	38.62

[a] Temporary ice obstruction.

Estimated monthly discharge of Housatonic River at Gaylordsville, Conn., etc.—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1903.					
January	4,190	1,082	2,627	2.574	2.96
February	25,700	1,982	6,421	6.293	6.54
March	11,116	3,076	6,198	6.074	7.00
April	6,700	1,642	3,485	3.415	3.82
May	1,574	584	977	.957	1.11
June	9,880	550	3,918	3.840	4.28
July	5,814	1,178	2,205	2.161	2.49
August	4,850	822	1,942	1.903	2.19
September	3,664	788	1,420	1.392	1.55
October	10,288	720	2,879	2.821	3.25
November	3,860	1,030	1,753	1.718	1.92
December	8,800	986	2,245	2.200	2.54
The year	25,700	550	3,006	2.946	39.65

TENMILE RIVER NEAR DOVER PLAINS, NEW YORK.

This station was established September 16, 1901, by R. E. Horton, assisted by A. E. Place. It is located at Tabor's highway bridge, about 2 miles upstream from the New York Central Railroad station at Dover Plains, N. Y. The standard chain gage, with inclosed scale, is attached to the lower chord on the upstream side of the bridge in the first panel from the right end. The length of the chain from the end of the weight to the marker is 17.19 feet. This gage was installed July 23, 1903, by F. H. Tillinghast, in place of the original wire gage. During 1903 the gage was read twice each day by J. J. O'Brien. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The initial point for soundings is the face of the right abutment under the upstream guard rail. The channel is straight for about 300 feet above and below the station and has a width of 85 feet between bridge abutments. The current has a moderate and well-distributed velocity. About 300 feet above the station there is a rift with a fall of about one-half foot. Both banks are covered with brush, and are subject to overflow only during extreme freshets. The bed of the stream is composed of sand and gravel. The channel is broken by an old bridge pier in the center of the stream. The bench mark is a circle cut on the upstream side of the right abutment near the bridge seat. Its elevation is 16.20 feet above the gage datum. This station was discontinued November 7, 1903.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Tenmile River near Dover Plains, N. Y., in 1901–1903.

Date.	Hydrographer.	Corrected gage height.	Discharge.
1901.		*Feet.*	*Second-feet.*
September 16	A. E. Place	.....	245
September 28	W. W. Schlecht	4.36	70
October 15	do	7.19	693
October 26	do	5.01	188
November 6	do	4.88	140
November 11	do	4.75	122
November 22	do	4.76	123
Do	do	4.76	121
December 2	do	4.75	125
December 17	do	8.41	[a] 1,213
1902.			
July 21	W. W. Schlecht	7.52	821
August 4	do	5.03	185
August 9	do	4.62	100
September 2	do	4.29	63
October 2	P. M. Churchill	6.14	443
November 14	F. H. Tillinghast	5.21	211
November 28	do	5.14	211
December 19	do	8.62	1,330
1903.			
January 10	F. H. Tillinghast	5.75	315
January 22	do	7.36	[b] 833
February 4	do	6.30	[c] 480
February 13	do	5.00	179
February 27	do	5.52	314
March 3	do	10.75	2,386
March 30	do	6.86	683
April 7	do	6.52	558
April 15	do	6.47	526
May 2	do	6.80	640
May 15	do	5.22	230
May 28	do	5.84	380
June 5	do	4.20	61
Do	do	4.21	57
June 10	do	4.79	158
June 30	do	5.26	249

[a] Floating ice. [b] River frozen over below bridge. [c] Ice along banks.

Mean daily gage height, in feet, of Tenmile River near Dover Plains, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.02	4.95	4.65
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.80	4.90	4.67
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.00	4.90	4.95
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.00	4.85	5.50
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.88	4.88	6.05
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.85	4.88	5.40
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.75	4.85	5.02
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.65	4.80	4.80
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.65	4.78	4.77
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.65	4.75	6.35
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.65	4.68	6.72
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.65	4.98	6.35
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.58	5.90	6.12
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.28	5.50	6.48
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.82	5.28	11.17
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.42	5.10	9.50
17	.....	.....	.....	.....	.....	.....	.....	.....	5.00	6.18	5.05	8.15
18	.....	.....	.....	.....	.....	.....	.....	.....	5.30	5.88	5.90	7.20
19	.....	.....	.....	.....	.....	.....	.....	.....	5.00	5.62	4.88	6.85
20	.....	.....	.....	.....	.....	.....	.....	.....	4.85	5.50	4.88	6.35
21	.....	.....	.....	.....	.....	.....	.....	.....	4.80	5.48	4.85	5.95
22	.....	.....	.....	.....	.....	.....	.....	.....	4.80	5.40	4.78	5.75
23	.....	.....	.....	.....	.....	.....	.....	.....	4.70	5.35	4.75	5.92
24	.....	.....	.....	.....	.....	.....	.....	.....	4.60	5.28	4.75	5.90
25	.....	.....	.....	.....	.....	.....	.....	.....	4.58	5.20	5.20	5.95
26	.....	.....	.....	.....	.....	.....	.....	.....	4.50	5.00	5.10	6.40
27	.....	.....	.....	.....	.....	.....	.....	.....	4.55	5.02	4.90	6.48
28	.....	.....	.....	.....	.....	.....	.....	.....	4.38	5.05	4.95	6.50
29	.....	.....	.....	.....	.....	.....	.....	.....	4.78	4.98	4.85	10.70
30	.....	.....	.....	.....	.....	.....	.....	.....	5.50	4.95	4.72	12.30
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.92	.....	10.22

Mean daily gage height, in feet, of Tenmile River near Dover Plains, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	7.70	5.40	a12.00	6.94	7.29	4.89	4.79	5.66	4.24	6.12	6.12	4.79
2	7.00	6.10	14.10	6.79	7.29	4.84	4.59	5.22	4.17	6.19	5.84	4.82
3	6.95	6.95	11.76	6.59	6.84	4.74	4.69	4.99	4.14	5.77	5.77	5.14
4	6.10	6.08	8.69	6.32	6.54	4.89	4.86	4.96	4.24	5.44	5.67	5.24
5	6.08	5.50	7.29	6.14	6.39	4.79	4.72	4.86	4.17	5.64	5.64	5.07
6	6.15	5.35	6.24	6.24	6.24	4.69	4.94	4.76	4.14	6.19	5.59	5.12
7	6.10	5.10	6.59	6.46	6.09	4.59	4.96	4.99	4.19	5.72	5.44	5.14
8	5.80	5.10	6.59	6.74	5.89	4.82	4.66	4.94	4.22	5.37	5.42	5.19
9	5.65	4.95	9.24	7.14	5.69	4.89	4.74	4.79	4.29	5.24	5.34	5.47
10	5.55	4.90	10.94	7.94	5.56	4.82	4.56	4.76	4.51	5.17	5.27	5.42
11	5.60	5.10	9.49	7.44	5.29	4.64	4.54	6.02	4.29	5.34	5.17	5.19
12	5.55	5.10	9.04	6.94	5.19	4.54	4.44	5.36	4.24	6.44	5.12	5.14
13	5.38	4.80	9.44	6.64	5.19	5.06	4.49	5.29	4.44	6.54	5.17	5.14
14	5.20	6.75	8.74	6.49	5.14	5.04	4.24	5.12	4.57	6.22	5.14	5.27
15	5.25	5.25	8.04	6.44	5.14	4.69	4.22	5.02	4.47	5.97	5.17	5.42
16	4.92	5.15	7.64	6.24	5.09	4.84	4.64	4.56	4.37	5.77	5.07	6.49
17	4.65	5.05	8.49	6.22	4.99	5.04	4.52	4.52	4.22	5.59	4.99	10.81
18	5.05	5.05	7.94	6.02	4.94	4.79	4.22	4.49	4.22	5.49	a4.96	9.47
19	5.10	5.00	6.89	5.92	4.99	4.62	4.36	4.49	4.37	5.62	4.94	8.62
20	5.05	4.85	6.46	5.79	5.02	4.49	4.99	4.52	4.62	5.54	4.87	8.04
21	5.05	4.75	6.44	5.69	4.92	4.74	7.32	4.59	4.67	5.24	4.89	8.08
22	11.95	4.68	6.49	5.56	4.84	4.94	7.49	4.56	4.47	5.14	4.92	11.84
23	8.10	4.40	6.54	5.46	4.74	4.72	6.69	4.44	4.49	5.09	4.89	10.99
24	6.35	4.50	6.59	5.36	4.64	4.66	6.09	4.42	4.42	5.07	4.87	8.92
25	5.80	4.65	6.39	5.29	4.64	4.49	6.02	4.42	4.44	4.99	4.92	8.29
26	5.70	5.82	6.24	5.29	5.39	4.44	5.84	4.32	4.42	4.89	5.04	7.82
27	7.80	8.45	6.19	5.64	5.64	4.84	5.64	4.26	5.04	4.94	5.27	7.39
28	7.45	9.72	7.76	5.59	5.89	4.39	5.74	4.19	6.84	7.44	5.12	6.97
29	6.55	.....	7.94	5.64	5.52	4.44	5.59	4.16	8.14	7.44	4.99	6.84
30	6.05	.....	7.64	7.34	5.14	5.04	5.99	4.14	6.32	6.72	4.87	6.89
31	5.50	.....	7.24	.....	5.04	.....	5.59	4.19	.....	6.34	.....	6.89

a Estimated.

Mean daily gage height, in feet, of Tenmile River near Dover Plains, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	6.82	6.64	11.09	7.04	4.79	4.29	7.96	4.82	6.42	4.65	5.88	.....
2	6.94	7.26	8.46	6.71	4.74	4.26	7.36	4.68	6.08	4.55	5.25	.....
3	7.52	7.24	7.49	6.49	4.79	4.16	6.69	4.58	5.85	4.48	5.22	.....
4	7.24	7.86	7.01	6.69	5.01	4.16	6.29	4.75	5.58	4.55	5.18	.....
5	6.74	10.59	6.81	6.71	4.81	4.16	6.02	6.02	5.55	4.58	5.30	.....
6	6.69	7.94	6.59	6.44	4.74	4.11	5.86	6.35	5.35	4.60	5.32	.....
7	6.41	7.09	6.49	6.39	4.66	4.54	5.74	7.65	5.20	4.52	5.20	.....
8	6.29	6.69	7.21	7.11	4.61	5.41	5.52	6.72	5.05	4.65	.....	.....
9	6.14	6.54	8.56	8.56	4.61	5.31	5.32	6.20	5.05	13.06	.....	.....
10	5.82	6.37	8.26	7.96	4.66	4.91	5.16	5.88	5.02	11.62	.....	.....
11	5.64	6.34	8.06	7.49	4.61	4.59	5.12	5.52	5.00	9.45	.....	.....
12	5.96	8.49	7.81	7.01	4.46	5.61	4.99	5.50	4.88	8.25	.....	.....
13	5.84	7.54	7.34	6.74	4.36	6.16	5.49	5.30	4.85	7.62	.....	.....
14	5.74	7.06	7.01	6.59	4.24	5.79	5.04	5.15	4.80	7.12	.....	.....
15	5.72	6.57	6.81	6.79	4.36	7.02	5.06	4.95	4.72	6.78	.....	.....
16	5.59	6.37	6.59	6.39	4.36	7.86	4.94	4.88	4.80	6.58	.....	.....
17	5.57	6.09	6.46	6.21	4.41	6.86	4.76	5.18	5.80	6.65	.....	.....
18	5.39	5.79	6.42	6.01	4.26	6.69	4.82	4.95	6.08	7.05	.....	.....
19	5.57	6.04	6.19	5.91	4.16	6.42	5.02	4.90	5.65	6.58	.....	.....
20	5.34	5.99	5.99	5.69	4.26	6.46	4.86	5.18	5.30	6.42	.....	.....
21	7.04	5.74	6.06	5.59	4.34	9.92	5.36	5.18	5.02	6.20	.....	.....
22	7.54	5.69	7.56	5.54	4.31	10.19	5.09	4.95	4.90	6.08	.....	.....
23	6.14	5.59	9.66	5.46	4.29	8.92	6.46	4.80	4.78	6.08	.....	.....
24	5.77	5.52	9.96	5.41	4.31	8.74	5.42	4.80	4.72	6.35	.....	.....
25	5.74	5.36	8.94	5.36	4.19	7.94	5.08	5.20	4.70	6.02	.....	.....
26	5.71	5.39	8.26	5.21	4.04	7.46	4.95	5.48	4.75	5.85	.....	.....
27	5.49	5.47	7.76	5.09	3.96	6.92	4.75	5.12	4.65	5.72	.....	.....
28	6.07	10.29	7.44	4.96	4.21	6.54	4.68	5.12	5.00	5.65	.....	.....
29	6.52	.....	7.04	4.86	4.59	7.24	4.60	7.30	4.80	5.52	.....	.....
30	7.99	.....	6.76	4.81	4.46	9.19	5.45	7.08	4.70	5.48	.....	.....
31	7.19	.....	7.31	.....	4.44	.....	5.38	6.78	.....	5.45	.....	.....

Rating table for Tenmile River near Dover Plains, N. Y., from September 17, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.50	10	5.45	270	7.40	846	9.35	1,651
3.55	13	5.50	280	7.45	863	9.40	1,674
3.60	16	5.55	293	7.50	880	9.45	1,698
3.65	19	5.60	306	7.55	899	9.50	1,722
3.70	22	5.65	319	7.60	917	9.55	1,747
3.75	25	5.70	332	7.65	936	9.60	1,772
3.80	28	5.75	345	7.70	954	9.65	1,798
3.85	31	5.80	358	7.75	973	9.70	1,823
3.90	34	5.85	371	7.80	991	9.75	1,849
3.95	37	5.90	384	7.85	1,010	9.80	1,874
4.00	40	5.95	397	7.90	1,028	9.85	1,899
4.05	46	6.00	410	7.95	1,047	9.90	1,924
4.10	51	6.05	425	8.00	1,065	9.95	1,950
4.15	57	6.10	439	8.05	1,085	10.00	1,975
4.20	62	6.15	454	8.10	1,105	10.05	2,002
4.25	68	6.20	468	8.15	1,126	10.10	2,029
4.30	73	6.25	483	8.20	1,146	10.15	2,056
4.35	79	6.30	497	8.25	1,166	10.20	2,083
4.40	84	6.35	512	8.30	1,186	10.25	2,110
4.45	90	6.40	526	8.35	1,206	10.30	2,137
4.50	95	6.45	541	8.40	1,226	10.35	2,164
4.55	103	6.50	555	8.45	1,247	10.40	2,191
4.60	111	6.55	571	8.50	1,267	10.45	2,218
4.65	119	6.60	586	8.55	1,289	10.50	2,245
4.70	127	6.65	602	8.60	1,311	10.55	2,274
4.75	135	6.70	617	8.65	1,333	10.60	2,302
4.80	143	6.75	633	8.70	1,354	10.65	2,331
4.85	151	6.80	648	8.75	1,376	10.70	2,360
4.90	159	6.85	664	8.80	1,398	10.75	2,389
4.95	167	6.90	679	8.85	1,420	10.80	2,417
5.00	175	6.95	695	8.90	1,442	10.85	2,446
5.05	186	7.00	710	8.95	1,464	10.90	2,474
5.10	196	7.05	727	9.00	1,486	10.95	2,503
5.15	207	7.10	744	9.05	1,510	11.00	2,532
5.20	217	7.15	761	9.10	1,533	11.05	2,562
5.25	228	7.20	778	9.15	1,557	11.10	2,592
5.30	238	7.25	795	9.20	1,580	11.15	2,623
5.35	249	7.30	812	9.25	1,604	11.20	2,654
5.40	259	7.35	829	9.30	1,628	11.25	2,684

Rating table for Tenmile River near Dover Plains, N. Y., from September 17, 1901, to December 31, 1903—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
11.30	2,714	12.15	3,258	13.00	3,850	13.85	4,494
11.35	2,745	12.20	3,292	13.05	3,887	13.90	4,533
11.40	2,775	12.25	3,326	13.10	3,924	13.95	4,572
11.45	2,806	12.30	3,360	13.15	3,961	14.00	4,611
11.50	2,836	12.35	3,394	13.20	3,998	14.05	4,652
11.55	2,868	12.40	3,427	13.25	4,036	14.10	4,692
11.60	2,900	12.45	3,461	13.30	4,073	14.15	4,733
11.65	2,932	12.50	3,495	13.35	4,110	14.20	4,773
11.70	2,964	12.55	3,531	13.40	4,148	14.25	4,814
11.75	2,996	12.60	3,566	13.45	4,185	14.30	4,854
11.80	3,028	12.65	3,602	13.50	4,222	14.35	4,895
11.85	3,060	12.70	3,637	13.55	4,261	14.40	4,935
11.90	3,092	12.75	3,673	13.60	4,299	14.45	4,976
11.95	3,125	12.80	3,708	13.65	4,339	14.50	5,017
12.00	3,157	12.85	3,744	13.70	4,378		
12.05	3,191	12.90	3,779	13.75	4,417		
12.10	3,224	12.95	3,815	13.80	4,455		

For open section. No logarithmic extension.

Mean daily discharge, in second-feet, of Tenmile River near Dover Plains, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	179	167	119
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	143	159	122
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	175	159	167
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	175	151	280
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	156	156	425
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	151	156	259
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	135	151	180
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	143	143
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	140	138
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	135	512
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	125	623
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	172	512
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	108	384	445
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	491	280	549
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	654	234	2,635
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	532	196	1,722
17	.....	.....	.....	.....	.....	.....	.....	.....	175	462	186	1,126
18	.....	.....	.....	.....	.....	.....	.....	.....	238	379	384	778
19	.....	.....	.....	.....	.....	.....	.....	.....	175	311	156	664
20	.....	.....	.....	.....	.....	.....	.....	.....	151	280	156	512
21	.....	.....	.....	.....	.....	.....	.....	.....	143	276	151	397
22	.....	.....	.....	.....	.....	.....	.....	.....	143	259	140	345
23	.....	.....	.....	.....	.....	.....	.....	.....	127	249	135	389
24	.....	.....	.....	.....	.....	.....	.....	.....	111	234	135	334
25	.....	.....	.....	.....	.....	.....	.....	.....	108	217	217	397
26	.....	.....	.....	.....	.....	.....	.....	.....	95	175	196	526
27	.....	.....	.....	.....	.....	.....	.....	.....	103	179	159	549
28	.....	.....	.....	.....	.....	.....	.....	.....	82	186	167	555
29	.....	.....	.....	.....	.....	.....	.....	.....	140	172	157	2,360
30	.....	.....	.....	.....	.....	.....	.....	.....	280	167	130	3,360
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	162	.....	2,094

Mean daily discharge, in second-feet, of Tenmile River near Dover Plains, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	954	[a]259	[a]3,157	692	809	157	141	322	67	445	445	141
2	710	439	4,692	645	809	149	109	221	59	465	368	146
3	695	695	3,002	583	661	132	125	173	56	350	350	205
4	439	433	1,350	503	568	157	153	169	67	268	324	226
5	433	280	809	451	523	141	130	153	59	316	316	190
6	454	249	480	480	480	125	165	137	56	465	303	200
7	439	196	583	544	436	109	169	173	61	337	268	205
8	358	196	583	630	381	146	121	163	64	253	263	215
9	319	167	1,599	758	329	157	133	141	72	226	247	274
10	293	159	2,497	1,043	296	146	105	137	96	211	232	263
11	306	196	1,717	860	236	117	101	416	72	247	211	215
12	293	196	1,505	692	215	101	89	251	67	538	200	205
13	255	143	1,693	599	215	188	94	236	89	568	211	205
14	217	633	1,372	552	205	184	67	200	106	474	205	232
15	228	228	1,081	538	205	125	64	179	92	402	211	263
16	162	207	932	480	194	149	117	105	81	350	190	552
17	119	186	1,263	474	173	184	98	98	64	303	170	2,423
18	186	186	1,043	416	162	141	64	94	64	278	169	1,708
19	196	175	676	389	173	114	78	94	81	311	163	1,319
20	186	151	544	355	179	94	173	98	114	290	154	1,081
21	186	135	538	329	162	133	819	109	122	226	157	1,097
22	3,125	125	552	296	149	165	876	105	92	205	162	3,054
23	1,105	84	568	272	133	130	614	89	94	194	157	2,526
24	512	95	583	251	117	121	436	86	86	190	154	1,451
25	358	119	523	236	117	94	416	86	89	173	162	1,182
26	332	363	480	236	257	89	368	75	86	157	184	996
27	991	1,247	465	316	316	149	316	69	184	165	232	843
28	863	1,833	977	303	381	83	342	61	661	860	200	701
29	571	.....	1,043	316	285	89	303	58	1,122	860	173	661
30	425	.....	932	826	205	184	407	85	503	623	154	676
31	280	.....	792	.....	184	.....	303	61	.....	509	.....	676

[a] Stream partly frozen; discharge approximate and probably too high.

Mean daily discharge, in second-feet, of Tenmile River near Dover Plains, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	654	599	2,586	724	141	72	1,051	146	532	119	255	.....
2	692	798	1,251	620	133	69	832	124	432	103	228	.....
3	887	792	877	552	141	58	614	108	371	93	221	.....
4	792	1,014	713	614	177	58	494	135	301	103	213	.....
5	630	2,296	651	620	145	58	416	416	293	108	238	.....
6	614	1,043	583	538	133	52	374	512	249	111	242	.....
7	529	741	552	523	121	102	342	936	217	98	217	.....
8	494	614	781	747	113	261	285	623	186	119	(b)	.....
9	451	568	1,293	1,293	113	240	242	468	186	3,894	.....	.....
10	363	518	1,170	1,051	121	161	209	379	179	2,912	.....	.....
11	316	509	1,089	877	113	109	200	286	175	1,698	.....	.....
12	a400	1,263	995	713	91	309	173	280	156	1,166	.....	.....
13	a368	895	826	630	80	457	278	238	151	924	.....	.....
14	a342	730	713	583	67	355	184	207	143	751	.....	.....
15	a337	577	651	645	80	717	188	167	130	642	.....	.....
16	a303	518	583	523	80	1,014	165	156	143	580	.....	.....
17	a298	436	544	471	85	667	137	213	358	602	.....	.....
18	a256	355	532	413	69	614	146	167	432	727	.....	.....
19	a298	422	465	387	58	582	179	159	319	580	.....	.....
20	a247	408	407	329	69	544	153	213	238	582	.....	.....
21	724	342	428	303	78	1,934	251	213	179	468	.....	.....
22	896	329	903	290	74	2,078	194	167	159	433	.....	.....
23	451	303	1,803	272	72	1,451	544	143	140	433	.....	.....
24	350	284	1,955	261	74	1,372	263	143	130	512	.....	.....
25	342	251	1,460	251	61	1,043	192	217	127	416	.....	.....
26	335	257	1,170	219	45	866	167	276	135	371	.....	.....
27	278	274	977	194	38	685	135	200	119	337	.....	.....
28	431	2,132	860	169	63	568	124	200	175	319	.....	.....
29	561	.....	724	153	110	792	111	812	143	285	.....	.....
30	1,062	.....	636	145	91	1,575	270	737	127	276	.....	.....
31	775	.....	815	.....	89	.....	255	642	.....	270	.....	.....

a Frozen above gage; discharge approximate. b End of record.

Estimated monthly discharge of Tenmile River near Dover Plains, N. Y., for 1901–1903.

[Drainage area, 195 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1901.					
October	654	108	232	1.190	1.37
November	384	125	179	.918	1.03
December	3,360	119	751	3.852	4.44
1902.					
January	3,125	119	516	2.647	3.06
February	1,833	84	335	1.718	1.79
March	4,692	465	1,227	6.294	7.26
April	1,043	236	502	2.575	2.88
May	809	117	308	1.580	1.82
June	188	83	135	.692	.77
July	876	64	242	1.241	1.43
August	416	58	143	.733	.84
September	1,122	56	151	.774	.86
October	860	157	363	1.862	2.14
November	445	154	225	1.154	1.28
December	3,054	141	778	3.991	4.60
The year	4,692	56	410	2.105	28.73
1903.					
January	1,062	247	499	2.559	2.95
February	2,296	251	688	3.529	3.67
March	2,586	407	935	4.796	5.53
April	1,293	145	504	2.585	2.89
May	177	38	94	.482	.55
June	2,078	52	627	3.216	3.59
July	1,051	111	296	1.518	1.74
August	936	108	312	1.600	1.84
September	532	119	221	1.133	1.26
October	3,894	93	645	3.308	3.82

MIANUS RIVER DRAINAGE BASIN.

The drainage basin of Mianus River is very narrow in the lower 2 miles of the stream, gradually widening toward the headwaters. The stream rises in New York near the Connecticut line, flows northerly to Bedford, where it turns abruptly to the south, crosses the line into Connecticut, and continues southeasterly until tide water is reached. The area above Bedford, N. Y., is hilly and irregular, the peaks rising 200 to 300 feet above the stream. A number of small tributaries converge near the head of a marshy flat, at the foot of which the gaging station is located.

The stream below Bedford flows in a narrow, deep valley and receives few tributaries. There are no lakes in the area, the only surface storage being in four small marsh tracts. The region is cleared meadow and farm land underlain by gneissic rock.

The drainage basin is shown on the Stamford sheet of the United States Geological Survey topographic map, from which the drainage areas given below have been determined.

The deep-cut valley, underlain by rock, and the comparative infrequency of tributaries favor the percolation of rainfall into the ground and the regulation of the flow by natural agencies. Considerable fall in the stream has been developed for purposes of power, beginning with a tide mill, now abandoned, at Mianus.

Drainage areas of Mianus River.

	Sq. miles.
Above Bedford, N. Y., gaging station	10.7
Above Buresch's mill, N. Y	11.2
Above undeveloped water-power site, Stanwich, Conn	18.7
Above River Bank mills, Conn	26.5
Above Sedgewicks, Conn., gaging station	28.8
Above Mianus Manufacturing Company's dam, Conn	29.4
Above Jessup Brothers' dam, Conn	29.6
Above Palmer Brothers' dam, Conn	29.9
Above mouth at Mianus, Conn	30.3

Stations were established by the Greenwich Water Company in January, 1903, near Stamford, Conn., and at Bedford, N. Y. These stations have been maintained during 1903 in cooperation with the Greenwich Water Company.

MIANUS RIVER NEAR STAMFORD, CONN.

The lower of the two gaging stations in the Mianus River drainage basin is located at Sedgewicks near Stamford, Conn., 2½ miles above the mouth of the river. It was established in January, 1903, by the engineers of the Greenwich Water Company. A vertical gage was fastened to the first bridge below Sedgewicks. Gage readings have been made twice each day.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Mianus River near Stamford, Conn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 7	L. H. Ireland	1.87	125.9
January 10	do	1.80	87.6
Do	do	1.93	108.9
January 15	do	2.58	[a] 100.4
Do	do	2.46	[a] 102.5
April 27	E. P. Roundey	1.25	44.0
Do	do	1.25	43.9
Do	do	1.25	[b] 37.6
May 14	do	.58	13.0
Do	do	.58	14.1
Do	do	.58	[b] 13.5
July 29	do	.42	7.0
July 30	do	.50	[b] 8.5
September 15	do	.66	[b] 16.5

[a] Anchor ice obstructing channel. [b] First bridge below Sedgewicks.

Mean daily discharge, in second-feet, of Mianus River near Stamford, Conn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	73.5	73.5	(a)	99.0	34.7	3.2	(a)	10.0	56.8	43.5	41.3	36.8
2	65.5	65.5	(a)	77.5	34.7	3.2	81.5	8.5	48.3	39.0	39.0	21.6
3	(a)	69.5	(a)	73.5	31.0	3.2	56.8	7.0	41.3	34.7	39.0	23.5
4	(a)	(a)	106.0	106.0	32.8	3.2	51.1	11.5	36.8	31.0	39.0	23.5
5	(a)	(a)	92.0	109.5	31.0	3.2	43.5	(a)	32.8	29.3	43.5	25.5
6	113.0	106.0	86.7	77.5	29.3	3.2	41.3	113.0	34.7	27.5	45.9	43.5
7	92.0	71.0	77.5	73.5	27.5	2.8	36.8	(a)	31.0	31.0	39.0	34.7
8	81.5	120.0	(a)	(a)	23.5	25.5	31.0	73.5	29.3	(a)	34.7	32.8
9	59.5	(a)	(a)	(a)	21.6	86.7	29.3	41.3	23.5	(a)	34.7	25.5
10	81.5	73.5	(a)	(a)	19.7	34.7	27.5	36.8	23.5	(a)	34.7	59.5
11	(a)	99.0	(a)	113.0	18.1	13.0	23.5	31.0	25.5	(a)	32.8	(a)
12	(a)	(a)	(a)	89.0	16.5	81.5	23.5	31.0	21.6	(a)	31.0	36.8
13	(a)	(a)	(a)	77.5	16.5	92.0	25.5	16.5	19.7	(a)	31.0	92.0
14	(a)	120.0	(a)	86.7	16.5	43.5	27.5	16.5	19.7	(a)	31.0	99.0
15	(a)	77.5	99.0	(a)	16.5	92.0	19.7	21.6	25.5	99.0	31.0	73.5
16	56.8	99.0	92.0	(a)	16.5	81.5	18.1	13.0	31.0	86.7	31.0	65.5
17	61.0	73.5	81.5	113.0	14.8	48.3	16.5	16.5	(a)	99.0	69.5	92.0
18	62.5	99.0	73.5	86.7	13.0	51.1	23.5	14.8	(a)	(a)	73.5	106.0
19	62.5	(a)	69.5	73.5	13.0	65.5	19.7	16.5	106.0	120.0	51.1	(a)
20	(a)	(a)	65.5	62.5	10.0	54.0	16.5	36.8	65.5	86.7	39.0	(a)
21	(a)	(a)	65.5	57.1	18.1	(a)	16.5	39.0	54.0	73.5	34.7	(a)
22	(a)	62.5	86.7	54.0	8.5	(a)	14.8	18.1	48.3	65.5	31.0	(a)
23	(a)	120.0	(a)	54.0	7.0	(a)	13.0	19.7	43.5	59.5	34.7	92.0
24	73.5	56.8	(a)	52.6	7.0	(a)	14.8	18.1	39.0	59.5	36.8	69.5
25	65.5	59.5	(a)	48.3	7.0	(a)	14.8	19.7	34.7	56.8	31.0	69.5
26	62.5	59.5	(a)	48.3	6.1	(a)	14.8	41.3	32.8	54.0	31.0	62.5
27	59.5	59.5	113.0	44.2	5.1	81.5	13.0	32.8	39.0	48.3	31.0	51.1
28	106.0	(a)	99.0	43.5	5.1	62.5	10.0	41.3	(a)	48.3	31.0	106.0
29	(a)	.....	86.7	39.0	5.1	(a)	7.0	(a)	86.7	43.5	43.5	(a)
30	(a)	.....	81.5	39.0	5.1	(a)	21.6	(a)	51.1	43.5	43.5	(a)
31	120.0	.....	(a)	.....	5.1	.....	13.0	81.5	.....	43.5	.....	(a)
Mean	76.2	82.4	86.0	71.9	16.7	42.5	25.5	30.6	40.8	57.5	38.7	58.4

[a] Above rating table.

MIANUS RIVER AT BEDFORD, N. Y.

This station was established in January, 1903, by the Greenwich Water Company. It is located at the highway bridge at Bedford, N. Y., 3¾ miles upstream from the point where the river crosses into Connecticut. The gage is a vertical rod graduated to feet and inches, and is attached to the bridge from which discharge measurements are made. During 1903 the gage was read twice each day by George Buresch.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Mianus River at Bedford, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 5	L. H. Ireland	1.67	55.4
January 8	do	1.33	39.3
Do	do	1.33	40.3
January 12	do	1.74	73.6
Do	do	1.83	78.8
January 16	do	1.08	29.6
Do	do	1.04	29.2
April 26	R. E. Horton	.93	18.0
April 27	E. P. Roundey	.90	17.9
Do	do	.90	18.2
May 14	do	.67	7.6
Do	do	.67	7.1
July 29	do	.42	3.6
July 30	do	.58	8.6
September 15	do	.54	8.5

Mean daily discharge, in second-feet, of Mianus River at Bedford, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	144.9	79.9	10.3	1.4	51.0	5.5	.....	39.5	34.7	21.7
2	29.5	.....	83.4	45.5	10.3	2.4	29.5	5.5	.....	39.5	29.5	21.7
3	124.7	.....	65.4	34.7	15.0	2.4	21.7	5.5	.....	39.5	34.7	21.7
4	119.7	.....	48.3	51.0	15.0	2.4	21.7	7.5	.....	39.5	34.7	21.7
5	61.8	.....	37.1	51.0	15.0	2.4	21.7	18.0	.....	39.5	42.5	21.7
6	51.0	.....	34.7	34.7	7.5	2.4	21.7	51.0	.....	29.5	45.5	21.7
7	51.0	.....	34.7	39.5	5.5	7.5	15.0	39.5	.....	29.5	39.5	29.5
8	39.5	.....	76.3	58.2	10.3	51.0	12.3	21.7	25.5	32.1	34.7	29.5
9	39.5	.....	134.8	114.6	10.3	29.5	12.3	21.7	25.5	(a)	39.5	32.1
10	109.6	.....	114.6	90.8	10.3	16.5	12.3	15.0	29.5	(a)	34.7	39.5
11	27.5	.....	79.9	51.0	10.3	7.5	12.3	15.0	21.7	(a)	34.7	37.1
12	58.2	.....	94.5	45.5	7.5	15.0	12.3	10.3	21.7	150.0	34.7	37.1
13	42.5	.....	79.4	45.5	5.5	15.0	15.0	10.3	21.7	51.0	34.7	114.6
14	25.5	.....	58.2	51.0	5.5	15.0	12.3	5.5	21.7	51.0	32.1	104.6
15	25.5	.....	45.5	124.7	5.5	29.5	7.5	5.5	8.9	76.3	29.5	61.8
16	25.5	.....	42.5	99.5	7.5	21.7	5.5	(b)	27.5	94.5	42.5	39.5
17	.....	.....	39.5	51.0	7.5	18.0	5.5	.....	(a)	83.4	69.1	34.7
18	.....	.....	34.7	45.5	7.5	21.7	5.5	.....	(a)	139.8	72.7	21.7
19	.....	.....	29.5	34.7	5.5	21.7	12.3	.....	124.7	99.5	45.5	21.7
20	.....	.....	34.7	29.5	5.5	42.5	12.3	.....	79.9	83.4	39.5	.....
21	.....	.....	29.5	29.5	2.4	99.5	12.3	.....	79.9	65.4	34.7	.....
22	.....	.....	45.5	25.5	2.4	104.6	12.3	.....	65.4	65.4	34.7	.....
23	.....	.....	124.7	25.5	1.4	114.6	12.3	.....	65.4	61.8	37.1	.....
24	.....	.....	144.9	25.5	5.5	114.6	7.5	.....	51.0	65.4	39.5	.....
25	.....	.....	119.7	25.5	7.5	94.5	7.5	.....	51.0	65.4	39.5	.....
26	.....	.....	65.4	21.7	5.5	48.3	7.5	.....	51.0	58.2	32.1	.....
27	.....	.....	51.0	18.0	5.5	29.5	5.5	.....	61.8	51.0	29.5	.....
28	.....	.....	51.0	15.0	3.5	25.5	3.5	.....	155.0	45.5	29.5	.....
29	.....	.....	51.0	15.0	1.4	29.5	3.5	.....	94.5	39.5	29.5	.....
30	.....	.....	34.7	12.3	1.4	144.9	5.5	.....	58.2	34.7	29.5	.....
31	.....	.....	61.8	.....	1.4	.....	5.5	.....	.....	34.7	.....	.....
Mean	55.4	.....	67.6	46.4	6.9	37.7	13.0	15.8	54.3	57.5	38.0	38.6

[a] Freshet.
[b] No record from August 16 to September 7, inclusive; repairing bridge; gage out.

Estimated monthly discharge of Mianus River at Bedford, N. Y., for 1903.

[Drainage area, 10.68 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches. [a]
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
January 2–16	.....	.....	55.4	5.19	5.97	3.68
February	.....	.....	.....	.....	.....	4.90
March	144.9	29.5	67.6	6.33	7.30	4.93
April	124.7	12.3	46.4	4.34	4.84	3.59
May	15.0	1.4	6.9	.65	.75	.36
June	144.9	1.4	37.7	3.53	3.94	10.15
July	51.0	3.5	13.0	1.22	1.41	2.79
August 1–15	51.0	5.5	15.8	1.48	1.71	9.66
September 8–30	.....	8.9	[b] 54.3	5.08	5.69	3.59
October	.....	29.5	[b] 57.5	5.38	6.19	7.77
November	72.7	29.5	38.0	3.56	3.97	1.53
December 1–19	114.6	21.7	38.6	3.61	4.15	4.32

[a] Mean of U. S. Weather Bureau records at Bedford, Primrose, and Norwalk.
[b] Excluding freshet discharge.

BYRAM RIVER DRAINAGE BASIN.

The source of Byram River is in Byram Lake, Westchester County, N. Y. The stream is joined just above the New York and Connecticut line by Wampus River, a small tributary from the west. It is joined by the middle branch of Byram River at Riverville. This stream in turn comprises two branches, known as the East and Middle branches of Byram River, which unite 1 mile above the junction with the main stream.

The stream flows from New York into the Connecticut near Armonk, traverses the western end of Fairfield County, Conn., and enters New York again at Port Chester. The tributary area is rolling, the ridges lying mostly in a northerly and southerly direction, and the difference of elevation being commonly from 100 to 200 feet. There are a number of marsh areas, some of which are one-fourth square mile in extent. There are many branching tributaries, and the area is quite uniformly though not minutely drained. It is mostly cleared land and is largely grass covered, being pasture or meadow with some tillage.

The drainage basin is underlain by igneous rock, diorite near the mouth with numerous outcrops, and granite and gneiss in the upper reaches. It is characterized by its stony, bowlder-covered surface.

During 1903 stations have been maintained through cooperation between the Geological Survey and the Greenwich Water Company at

the following points: Byram River at Pemberwick, Conn.; West Branch Byram River at Schilt's Mill, Conn.; East Branch Byram River, near Round Hill, Conn.; Middle Branch Byram River at Riverville, Conn.

Drainage areas in Byram River basin.

	Sq. miles.
West Branch:	
Above foot of Byram Lake, N. Y.	1.2
Above State line, New York City dam	7.7
Above gaging station dam	11.2
Above junction with East Branch	12.2
East Branch:	
Above gaging station (R. G. Jones farm)	4.8
Above R. G. Jones mill	5.0
Above junction with Middle Branch	7.3
East and Middle branches at junction	11.4
East and Middle branches at Cat Rock	11.6
East and Middle branches, Smith sawmill	11.6
East and Middle branches, junction West Branch	12.1
Byram River:	
Above junction of main branches as above	24.3
Above Reynolds shoddy mill	26.6
Above Tingue Mill, Glenville, Conn	26.7
Above Port Chester Bolt and Nut Company, Pemberwick (gaging station)	27.2
Above mouth (Port Chester, N. Y.)	31.7

BYRAM RIVER AT PEMBERWICK, CONN.

This station was established January 3, 1903, by the Greenwich Water Company. It is located at the masonry dam of the Port Chester Bolt and Nut Company. The dam has a level crest about 60 feet in length. The discharge at this point is obtained by computing the flow over the crest of the dam and the flow through two turbines. The rating of the turbines has been checked by meter measurements and the discharge through them is computed from the recorded daily run, gate opening, and head. The station is located below the junction of all the main branches of the river. It is 1 mile below Glenville, and 3 miles above the mouth of the river at Port Chester, N. Y. This station shows, therefore, nearly the entire yield of the drainage basin, with the exception of the diversion by New York City above the New York State line. The observer at this point during 1903 was Clifford Reynolds.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Byram River at Pemberwick, Conn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	[a] 73.4	[a] 233.4	68.6	[b] 55.8	[b] 5.0	55.9	5.0	39.0	30.1	[a] 39.9	17.6
2	.....	43.6	86.2	57.3	10.4	(b)	56.4	[a] 5.0	39.0	21.0	27.1	(b)
3	331.7	39.0	68.6	57.3	[a] 39.9	(b)	28.1	9.5	27.1	27.6	39.9	(b)
4	[a] 164.0	187.5	68.6	92.2	18.6	(b)	26.0	.....	27.1	[a] 26.0	21.0	(b)
5	105.3	115.5	57.3	[a] 113.5	16.8	(b)	26.0	223.6	20.3	21.0	30.1	14.1
6	90.8	69.2	57.3	57.3	15.6	(b)	18.0	55.7	[a] 55.8	21.0	30.1	[a] 14.1
7	65.4	38.6	52.3	73.2	17.2	(a, b)	13.0	98.8	39.9	21.0	21.7	20.0
8	65.4	[a] 146.4	[a] 170.1	86.2	14.0	39.9	13.0	20.1	18.0	21.0	[a] 26.0	39.9
9	37.6	110.4	220.1	147.8	10.4	32.9	13.0	[a] 26.0	18.0	1,275.4	21.0	5.0
10	18.9	55.0	130.3	105.3	[a] 5.0	39.9	13.0	20.6	18.0	324.9	21.0	55.8
11	[a] 47.8	52.7	165.6	68.2	15.6	26.0	6.1	15.2	27.1	[a] 207.8	21.0	26.0
12	100.4	207.8	121.9	[a] 73.4	12.8	143.2	(a)	15.6	11.1	173.8	21.0	39.9
13	65.2	90.2	92.6	52.7	(b)	14.6	12.8	15.6	[a] 26.0	150.8	21.0	[a] 158.0
14	37.6	61.0	77.4	52.7	(b)	[a] 73.4	12.8	15.6	18.0	108.3	27.6	55.8
15	27.1	[a] 73.4	[a] 73.4	364.1	(b)	65.2	.....	7.4	13.0	71.6	[a] 26.0	20.0
16	31.7	91.2	57.5	147.8	(b)	29.9	.....	(a, b)	102.7	71.6	21.0	26.0
17	26.7	60.8	57.5	105.3	(a, b)	15.2	.....	15.6	274.4	63.3	30.1	9.5
18	[a] 55.8	52.9	57.5	82.6	14.1	15.2	5.0	(b)	147.8	[a] 92.5	55.9	14.1
19	[a] 22.6	39.0	50.5	[a] 75.2	1.2	15.2	[a] 32.9	(b)	98.6	71.8	55.9	39.9
20	20.0	31.7	43.6	52.7	1.2	11.6	5.0	47.8	[a] 92.5	55.9	30.1	[a] 247.7
21	532.8	38.6	38.6	52.9	1.2	[a] 135.0	5.0	39.9	60.6	55.9	14.8	176.8
22	136.8	[a] 92.5	[a] 112.9	39.0	14.1	52.7	5.0	39.9	45.7	48.9	[a] 32.9	45.7
23	68.6	50.5	375.5	39.0	9.5	105.3	39.9	[a] 14.1	29.9	42.0	21.0	45.7
24	23.3	50.5	220.6	39.0	(a)	147.8	14.1	20.0	29.9	40.5	21.0	38.8
25	[a] 39.9	43.6	125.7	29.3	14.1	52.7	5.0	9.5	24.5	[a] 55.8	21.0	39.9
26	31.6	37.6	90.8	[a] 39.9	2.4	32.8	[a] 5.0	39.9	35.3	34.9	26.0	39.9
27	31.6	43.6	86.2	27.1	.....	11.6	14.1	26.0	[a] 39.9	33.0	21.0	[a] 26.0
28	68.6	644.4	65.0	30.1	.....	[a] 26.0	9.5	27.2	122.9	30.1	7.6	27.1
29	86.2	.....	[a] 73.4	17.3	.....	220.8	5.0	220.8	45.7	30.1	(a)	27.1
30	170.8	.....	57.3	35.0	5.0	125.7	14.1	[a] 73.4	38.8	30.1	17.6	27.1
31	82.6	.....	105.3	.....	5.0	.....	9.5	62.5	.....	19.4	.....	27.1
Mean	89.2	94.3	106.2	76.1	13.6	59.9	17.2	43.3	52.9	105.7	26.6	47.3

[a] Sunday. [b] Record approximate owing to alternate drought and refilling of pond.

WEST RRANCH BYRAM RIVER NEAR PORT CHESTER, N. Y.

This station was established January 15, 1903, by the Greenwich Water Company. It is located at an unused timber dam at Schilts mill, 2 miles above the mouth of the West Branch. The observer is August Schilt. During a portion of the year the entire flow is diverted from this branch at a dam 1,100 feet north of the New York-Connecticut State line. This dam affords a storage of 180 million gallons, of which 100 million gallons are available. The gates and the overflow discharge into an open channel 3,800 feet long, which leads into the Bronx River drainage basin, from which the water is conducted to the city of New York. The storage in Byram Lake, which has an area of 160 acres, aggregates 550 million gallons and is also available. The total area tributary to the New York City conduit is 7.66 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of West Branch Byram River near Port Chester, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	28.30	96.58	34.94	12.42	(a)	6.37	1.00	22.63	16.96	12.42	1.00
2	.....	22.63	41.58	28.30	12.42	(a)	1.00	1.00	19.80	16.96	12.42	1.00
3	.....	22.63	34.94	28.30	7.87	(a)	0.00	1.00	14.69	14.69	12.42	1.00
4	.....	49.29	31.62	45.44	7.87	(a)	0.00	1.00	10.14	12.42	12.42	1.00
5	.....	45.44	28.30	45.44	10.14	(a)	1.00	16.96	12.42	12.42	14.69	1.00
6	.....	28.30	28.30	31.62	7.87	(a)	1.00	16.96	22.63	12.42	16.96	1.00
7	.....	22.63	28.30	31.62	7.87	(a)	1.00	4.87	10.14	12.42	12.42	1.00
8	.....	38.26	53.15	57.00	4.87	(a)	1.00	1.87	7.87	12.42	12.42	1.00
9	.....	41.58	82.70	82.70	(a)	(a)	1.00	1.00	4.87	282.50	7.87	1.00
10	.....	28.30	57.00	49.29	(a)	(a)	1.00	1.00	1.87	195.70	7.87	1.00
11	.....	41.58	53.15	38.26	(a)	(a)	1.00	1.00	7.87	101.45	7.87	1.00
12	.....	82.70	53.15	31.62	(a)	22.63	1.00	1.00	1.87	78.20	7.87	1.00
13	.....	38.26	41.58	28.30	(a)	1.87	1.00	1.00	1.87	69.52	7.87	16.96
14	.....	31.62	38.26	38.26	(a)	1.00	1.00	1.00	1.87	57.00	7.87	6.37
15	31.62	28.30	34.94	121.55	(a)	12.42	1.00	1.00	1.87	49.29	7.87	1.87
16	22.63	31.62	28.30	82.70	(a)	4.87	1.00	1.00	61.18	38.26	10.14	1.87
17	24.46	22.63	28.30	49.29	(a)	0.00	1.00	1.00	195.70	38.26	22.63	1.20
18	19.80	31.62	28.30	41.58	(a)	0.00	1.00	1.00	101.45	61.18	24.46	1.00
19	12.42	31.62	28.30	34.94	(a)	3.37	1.00	1.00	69.52	38.26	14.69	0.00
20	22.63	57.00	28.30	28.30	(a)	6.37	1.00	1.00	49.29	28.30	12.42	41.58
21	154.40	45.44	22.63	28.30	(a)	19.80	1.00	1.87	38.26	28.30	7.87	61.18
22	78.20	24.46	38.26	22.63	(a)	7.87	1.00	1.00	34.94	22.63	7.87	6.37
23	38.26	22.63	99.02	22.63	(a)	16.96	1.00	1.00	24.46	22.63	7.87	1.87
24	22.63	19.80	96.58	22.63	(a)	22.63	1.00	1.00	16.96	22.63	7.87	1.87
25	22.63	22.63	61.18	19.80	(a)	12.42	1.00	1.00	14.69	22.63	7.87	1.87
26	19.80	19.80	45.44	16.96	(a)	1.87	1.00	1.00	12.42	16.96	7.87	1.87
27	19.80	24.46	41.58	16.96	(a)	1.20	1.00	1.00	41.58	16.96	3.37	1.87
28	38.26	174.40	34.94	16.96	(a)	0.00	1.00	1.00	61.18	16.96	1.87	7.87
29	53.15	.....	34.94	16.96	(a)	57.00	1.00	38.26	28.30	16.96	1.87	10.14
30	57.00	.....	28.30	14.69	(a)	34.94	1.00	49.29	22.63	16.96	1.20	7.87
31	34.94	.....	49.29	.....	(a)	.....	1.00	28.30	.....	14.69	.....	16.96
Mean	39.57	38.53	45.07	37.60	8.92	11.96	1.11	5.85	30.50	44.09	10.03	6.54

a Discharge very small.

EAST BRANCH BYRAM RIVER NEAR GREENWICH, CONN.

This station was established January 1, 1903, by the Greenwich Water Company. It is located at a small private bridge just above R. G. Jones's mill on the road from Round Hill to Greenwich. It is about 4 miles north of Port Chester, N. Y. At this point the stream flows out from a swamp, within the limits of which the two branches unite. A small dam on one of these branches controls the discharge at times. At the gaging station the section is about 20 feet wide and 1½ feet deep at ordinary stages. The bed is composed of coarse gravel and cobblestones. The current has a moderate velocity at ordinary stages. The observer is R. G. Jones.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of East Branch Byram River near Greenwich, Conn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 3	L. H. Ireland	2.35	[a] 100.6
January 7	do	1.50	21.6
January 9	do	1.92	36.7
Do	do	1.90	36.9
April 29	E. P. Roundey	1.21	[b] 1.7
Do	do	1.21	[c] 3.7
May 14	do	1.08	1.6
July 29	do	.91	[c] .7
July 30	do	1.00	[c] 1.1
September 15	do	1.10	[c] 2.3
September 16	do	1.06	[c] 2.0

[a] Conditions unfavorable.
[b] Unfavorable section for measurement.
[c] Measured 100 feet below gage.

Mean daily discharge, in second-feet, of East Branch Byram River near Greenwich, Conn., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	103.0	21.5	5.2	0.73	24.8	0.73	15.7	6.7	15.7
2	39.4	18.6	3.6	.63	21.5	.73	10.5	6.7	15.7
3	28.0	21.5	3.6	.63	18.6	.73	8.6	6.7	15.7
4	21.5	39.4	6.7	.63	15.7	.94	6.7	5.9	15.7
5	21.5	21.5	5.2	.73	10.5	(a)	6.7	5.2	24.8
6	21.5	21.5	3.6	.73	10.5	70.3	10.5	5.2	24.8
7	21.5	21.5	3.6	6.70	5.2	59.0	5.2	5.9	21.5
8	78.0	43.0	3.6	21.5	3.2	18.6	3.6	6.7	18.6
9	95.0	46.8	2.8	8.6	1.9	8.6	3.6	(a)	15.7
10	54.8	31.9	1.9	3.6	1.9	5.2	3.6	(a)	13.1
11	74.0	21.5	1.9	1.9	1.9	3.6	8.6	(a)	13.1
12	39.4	21.5	1.9	103.0	1.9	3.6	3.6	(a)	10.5
13	28.0	21.5	1.9	21.5	13.1	1.9	2.3	107.0	10.5
14	21.5	39.4	1.7	13.1	6.7	1.53	1.9	21.5	10.5
15	21.5	(a)	1.53	35.7	2.8	1.53	1.9	21.5	10.5
16	21.5	46.8	1.15	18.6	1.9	1.15	62.8	21.5	15.7
17	21.5	31.9	1.15	8.6	1.15	1.15	(a)	31.9	35.7
18	21.5	21.5	1.15	15.7	2.75	1.15	(a)	54.8	28.0
19	18.6	21.5	.83	21.5	13.1	1.15	82.0	21.5	20.0
20	21.5	18.6	.83	21.5	6.7	21.5	82.0	21.5	15.7
21	15.7	15.7	.73	82.0	2.8	18.6	82.0	15.7	10.5
22	31.9	15.7	.94	31.9	5.2	3.6	13.1	15.7	6.7
23	(a)	10.5	.83	59.0	6.7	1.53	5.9	15.7	6.7
24	82.0	10.5	.73	107.0	2.8	1.15	5.2	15.7	6.7
25	39.4	10.5	.73	35.7	1.53	5.2	3.6	13.1	3.6
26	24.8	10.5	.73	21.5	1.15	8.6	3.6	13.1	3.6
27	21.5	8.6	.73	21.5	1.04	5.2	54.8	15.7	3.6
28	21.5	6.7	.73	14.4	.73	(a)	54.8	18.6	3.6
29	21.5	6.7	.73	107.0	.73	(a)	21.5	18.6	1.9
30	21.5	6.7	.73	66.5	1.15	35.7	8.6	18.6	1.9
31	31.9	.....	.73	.....	1.04	21.5	.....	15.7	.....
Mean	36.2	21.8	2.0	28.4	6.2	10.9	20.5	19.1	13.4

[a] Above rating table.

Estimated monthly discharge of East Branch Byram River near Greenwich, Conn., in 1903.

[Drainage area, 4.84 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	Inches.
January						3.68
February						4.90
March	103.0	15.7	36.2	7.46	8.60	4.93
April	46.8	6.7	21.8	4.49	5.01	3.59
May	6.7	.73	2.0	.41	.47	.36
June	107.0	.63	28.4	5.85	6.53	10.15
July	24.8	.73	6.2	1.27	1.46	2.79
August	70.3	.73	10.9	2.24	2.58	9.66
September	62.8	1.9	20.5	4.22	4.71	3.59
October	107.0	5.2	19.1	3.93	4.53	7.77
November	35.7	1.9	13.4	2.76	3.08	1.53
December						4.32

MIDDLE BRANCH BYRAM RIVER NEAR RIVERVILLE, CONN.

This station was established May 17, 1903. It is located at a point just above the mouth of the branch and 1½ miles below the junction of the East and Middle branches. The measurements made during 1903 afford data for an estimate of the low-water flow only. There is no extensive storage on this branch, and no diversion from this portion of the drainage basin. The observer for 1903 was George Derby.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Middle Branch Byram River at Riverville, Conn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 16	E. P. Roundey	0.90	[a] 4.5
July 29	do	.75	1.7
July 30	do	.85	3.4
September 16	do	.90	5.5

[a] Conditions not favorable.

Mean daily gage height, in feet, of Middle Branch Byram River near Riverville, Conn., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.78	1.78	0.82	1.45	1.30	1.20	0.92
2	.....	.72	1.52	.80	1.32	1.20	1.20	.90
3	.....	.72	1.42	.80	1.28	1.15	1.20	.95
4	.....	.75	1.30	.80	1.20	1.00	1.20	1.05
5	.....	.70	1.28	3.30	1.22	1.20	1.38	1.08
6	.....	.70	1.22	1.85	1.45	1.15	1.42	1.00
7	.....	.75	1.20	2.30	1.25	1.15	1.28	1.02
8	.....	1.60	1.05	1.80	1.15	1.20	1.20	1.05
9	.....	1.30	1.00	1.28	1.10	4.70	1.20	1.08
10	.....	1.00	1.00	1.20	1.10	3.70	1.20	1.55
11	.....	.90	1.05	1.12	1.25	2.80	1.20	1.40
12	.....	2.23	.90	1.08	1.10	2.52	1.20	1.30
13	.....	1.55	.90	1.02	1.05	2.40	1.20	2.08
14	.....	1.15	1.10	1.00	1.02	1.75	1.22	2.00
15	.....	1.80	1.00	1.00	1.00	1.65	1.20	1.50
16	.....	1.60	.95	.95	2.35	1.55	1.20	1.30
17	0.88	1.20	1.00	.92	2.65	1.65	1.50	1.10
18	.80	1.38	1.45	.95	2.02	2.20	1.58	1.08
19	.80	1.45	1.15	.90	1.82	1.62	1.45	1.10
20	.85	1.45	1.05	1.45	1.80	1.50	1.32	2.92
21	.80	2.50	1.00	1.15	1.80	1.48	1.22	2.90
22	.85	1.75	1.05	1.00	1.52	1.45	1.20	2.32
23	.82	2.15	1.15	.90	1.38	1.40	1.25	1.68
24	.78	2.60	.95	.92	1.28	1.40	1.22	1.60
25	.88	2.00	.90	.98	1.12	1.35	1.20	1.60
26	.78	1.65	.80	1.40	1.10	1.30	1.20	1.60
27	.75	1.48	.80	1.15	1.20	1.22	1.18	1.70
28	.78	1.38	.80	1.50	2.35	1.20	1.05	1.50
29	.82	2.92	.82	3.10	1.60	1.20	.92	1.42
30	.75	2.40	.90	1.95	1.40	1.20	.95	1.40
31	.78	.....	.85	1.65	.....	1.20	.....	1.35

HUDSON RIVER DRAINAGE BASIN.

Hudson River rises in Essex County, N. Y., in the Adirondack Mountains, flows southeast and south a distance of about 300 miles, and empties into New York Bay. The southern half of the river, from Troy to the mouth, has been termed a submerged river, or an arm of the sea, the fall of the surface being only 2.1 feet in 150 miles at mean low tide. In the upper half of its course its fall is very rapid, the difference in elevation of the surface between Troy and Lake Fear-of-the-Clouds being 4,322 feet. The principal tributary is Mohawk River, which enters the Hudson at Troy. Other tributaries are Indian, Clear, Schroon, Hoosic, and Secondaga rivers. About three-fourths of the drainage area above the Mohawk is mountainous in character, heavily wooded, and contains a few small lakes and ponds. The mountain peaks have an altitude of from 3,000 to 5,000 feet, and are generally of granite, gneiss, or mica-schist. With the exception of the

Catskill Mountain region the drainage area below Troy is mainly hilly country. The rapid fall of this river in the upper half of its course makes the stream very valuable for power purposes, but the absence of large lake storage causes its summer flow to be small and renders artificial storage necessary.

The following is a list of the stations in the Hudson River drainage basin:

Foundry Brook near Coldspring, N. Y.
Fishkill Creek at Glenham, N. Y.
Wappinger River above Wappinger Falls, N. Y.
Wallkill River at Newpaltz, N. Y.
Delaware and Hudson Canal at Creeklocks, N. Y.
Rondout Creek at Rosendale, N. Y.
Rondout Creek at Honk Falls, N. Y.
Esopus Creek at Kingston, N. Y.
Esopus Creek near Shokan, N. Y.
Catskill Creek at South Cairo, N. Y.
Mohawk River at Dunsbach Ferry, N. Y.
Schoharie Creek at Mill Point, N. Y.
Schoharie Creek at Prattsville, N. Y.
East Canada Creek at Dolgeville, N. Y.
Mohawk River at Little Falls, N. Y.
West Canada Creek at Twin Rock Bridge, N. Y.
Mohawk River at Utica, N. Y.
Starch Factory Creek near New Hartford, N. Y.
Reels Creek near Deerfield, N. Y.
Johnson Brook near Deerfield, N. Y.
Graefenberg Creek near New Hartford, N. Y.
Sylvan Glen Creek near New Hartford, N. Y.
Oriskany Creek near Oriskany, N. Y.
Hudson River at Mechanicville, N. Y.
Hoosic River at Buskirk, N. Y.
Hudson River at Fort Edward, N. Y.
Schroon River at Warrensburg, N. Y.
Indian River at Indian Lake Dam, N. Y.

FOUNDRY BROOK NEAR COLDSPRING, N. Y.

The drainage basin of this stream lies east of Hudson River, from which it is separated by Breakneck Ridge. A gaging weir was erected near North Highland October 31, 1902, by the engineers of the Fishkill-Matteawan Water Company, and readings were taken on a gage placed 6 feet upstream from the weir at 7 a. m. and 6 p. m. until January 31, 1903. The drainage area above the weir is of gneissic rock, precipitous, and covered with second-growth, hardwood trees and brush. Two storage reservoirs for a water power at the mouth of the stream are situated upstream from the point of gaging. The capacity of the upper is 27,127,500 cubic feet; of the lower, 27,526,000 cubic feet. The upper one was empty and the lower nearly so when the gagings began, and both were empty during the major portion of the period of gaging. The weir had a thin crest 6 feet in length with

two end contractions. The discharge was calculated by the Francis formula.

The stream makes a descent of nearly 300 feet in the lower 2 miles of its course, entering Hudson River below Coldspring, where power is developed under a fall of 90 feet. A modern turbine, a Pelton-type impulse wheel, and an overshot wheel of 40 feet diameter (the last no longer used) stand side by side. The stream also serves as a source of water supply to Coldspring Village, a reservoir of 12 million gallons capacity being formed by a masonry dam.

The drainage area above the gaging weir is 1.38 square miles, and above the mouth of the stream 5.30 square miles.

Mean daily discharge, in second-feet, of Foundry Brook near Coldspring, N. Y., for 1902.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	1.08	0.55	12	0.95	0.67	23	0.48	9.62
2	.92	.55	13	.75	.67	24	.48	8.08
3	1.15	1.40	14	.75	.67	25	.48	7.88
4	1.02	.90	15	.68	.67	26	1.00	7.20
5	1.00	3.50	16	.63	6.89	27	.78	6.05
6	1.08	3.15	17	.58	7.22	28	.67	5.95
7	8.65	.67	18	.58	6.65	29	.67	5.25
8	5.75	1.00	19	.58	8.28	30	.67	3.85
9	1.12	.90	20	.48	8.38	31		4.48
10	1.00	.75	21	.48	8.25			
11	1.00	.55	22	.48	(a)			

[a] Above weir.

Mean daily discharge, in second-feet, of Foundry Brook near Coldspring, N. Y., for 1903.

Day.	Jan.	Day.	Jan.	Day.	Jan.	Day.	Jan.
1	4.30	9	4.48	17	2.40	25	3.10
2	4.00	10	3.75	18	2.35	26	2.85
3	(a)	11	1.80	19	2.00	27	2.80
4	4.00	12	1.80	20	1.80	28	3.25
5	3.10	13	1.28	21	10.15	29	3.60
6	5.25	14	1.28	22	8.10	30	4.20
7	[a] 8.10	15	1.80	23	5.62	31	3.35
8	5.55	16	2.18	24	3.40		

[a] Drawing down lower storage pond.

FISHKILL CREEK AT GLENHAM, N. Y.

This station was established July 8, 1901, at the Newburgh, Dutchess and Connecticut Railroad bridge at Glenham, N. Y. The station was discontinued November 7, 1903. The wire gage is attached to the upstream guard rail of the bridge. It was read twice each day by C. E. Cary. Discharge measurements were made from the bridge to which the gage is attached. The bridge consists of a central main

span, 95 feet in length, and two end spans which cross overflow channels, each having a length of 22 feet. The bed of the stream under the main span is composed of earth and gravel. In the overflow channels the bed is composed of loose broken stone. The bench mark is a circle chiseled on the upstream corner of the left pier of the main bridge span. Its elevation is 17.78 feet above gage datum. Owing to changes in the gage datum and to the modification of the cross section by the flood of December 15, 1901, the gage heights as hitherto published have required special correction to reduce them to a common datum. They do not represent the correct relative stage of the stream on the different dates. The corrected records and computations for the three years during which the station was maintained are published on the following pages.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Fishkill Creek at Glenham, N. Y., for 1901–1903.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.[a]	
1901.		*Feet.*	*Feet.*	*Second-feet.*
July 8	R. E. Horton and G. B. Hollister.	3.92	3.92	147
July 20	A. E. Place	3.90	3.90	135
July 24	do	3.60	3.60	60
August 15	do	3.85	3.85	110
August 21	do	4.56	4.56	342
September 6	do	4.15	4.15	193
September 18	do	4.22	4.22	229
September 27	W. W. Schlecht	3.86	3.86	90
October 5	do	3.98	3.98	126
October 12	G. B. Hollister	4.80	4.80	97
October 15	W. W. Schlecht	5.10	5.10	579
October 25	do	4.05	4.05	137
November 11	do	3.85	3.85	82
November 20	do	3.95	3.95	114
December 7	do	4.25	4.23	[b]101
December 13	do	4.62	4.60	375
December 24	do	4.52	4.50	315
December 31	do	7.43	7.41	2,335

[a] Correction due to change in length of gage wire.
[b] Ice 0.4 inch thick.

Discharge measurements of Fishkill Creek at Glenham, N. Y., etc.—Continued.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.[a]	
1902.		*Feet.*	*Feet.*	*Second-feet.*
January 17	W. W. Schlecht	4.30	4.27	[b]171
February 1	do	5.05	5.01	[b]474
February 11	do	4.87	4.83	[c]202
March 5	do	5.79	5.74	1,129
April 12	do	5.30	5.24	773
April 25	do	4.03	3.97	152
May 6	do	4.46	4.40	350
June 2	do	3.78	3.75	132
June 17	do	4.00	3.97	212
July 14	do	3.18	3.19	64
July 28	do	3.90	3.91	200
August 11	do	3.51	3.58	115
August 26	do	3.04	3.11	48
October 11	P. M. Churchill	3.71	3.81	155
October 30	C. C. Covert	4.97	5.07	648
November 8	F. H. Tillinghast	4.00	4.09	233
November 25	do	3.65	3.74	146
1903.				
January 13	F. H. Tillinghast	5.00	5.09	[d]261
March 2	do	6.20	6.28	1,520
May 13	do	3.40	3.48	99
May 21	do	3.34	3.42	80
July 28	do	3.55	3.63	116
September 5	do	4.52	4.60	345

[a] Correction due to change in length of gage wire.
[b] Ice below station.
[c] Ice 0.2 to 0.8 inch thick.
[d] Ice above and below station.

Mean daily gage height, in feet, of Fishkill Creek at Glenham, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1								3.95	4.58	4.05	3.98	3.88
2								3.82	4.60	3.98	3.95	a3.96
3								3.78	4.48	4.10	3.95	4.03
4								3.68	4.42	4.10	3.95	4.06
5								3.65	4.30	4.00	3.90	4.08
6								3.65	4.15	3.92	3.90	4.23
7								4.70	4.18	3.90	3.92	4.26
8							3.90	5.55	4.10	3.88	3.95	4.16
9							3.90	4.78	4.08	3.85	3.90	a4.03
10							3.80	4.35	4.02	3.85	3.88	4.71
11							3.78	4.12	4.05	3.85	3.88	5.31
12							3.82	4.08	4.38	3.80	3.92	4.81
13							3.80	4.02	4.32	3.80	4.32	4.58
14							3.72	3.90	4.15	4.30	4.18	4.66
15							3.70	3.90	4.10	4.85	4.05	6.76
16							3.65	3.82	4.25	4.82	4.00	7.43
17							3.72	3.85	4.15	4.55	3.95	6.16
18							4.22	5.08	4.22	4.40	3.95	5.51
19							4.00	4.70	4.12	4.32	3.95	5.13
20							3.90	4.40	4.02	4.22	3.95	4.96
21							3.78	4.45	4.02	4.20	3.93	4.76
22							3.70	4.95	4.00	4.15	3.93	4.71
23							3.65	4.62	3.92	4.12	3.90	4.71
24							3.65	4.70	3.90	4.10	3.90	4.58
25							3.65	6.40	3.88	4.05	4.35	4.58
26							3.62	6.55	3.85	4.00	4.33	4.53
27							3.60	5.65	3.80	4.00	4.13	4.83
28							3.45	5.20	3.88	4.00	4.03	5.13
29							3.58	4.85	3.95	4.00	4.00	4.73
30							4.35	4.70	4.20	4.00	3.98	8.26
31							4.15	4.58		3.98		7.48

a River frozen.

Mean daily gage height, in feet, of Fishkill Creek at Glenham, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.02	4.96	12.95	4.84	5.42	3.79	3.71	3.87	3.00	4.35	4.49	3.79
2	6.62	4.71	9.95	4.72	4.86	3.67	3.53	3.77	2.90	4.30	4.41	3.82
3	5.47	5.58	8.73	4.62	4.64	3.57	3.46	3.67	3.05	4.10	4.29	3.97
4	5.27	5.51	6.65	4.54	4.66	3.67	3.86	3.67	2.82	3.92	4.24	4.12
5	5.15	5.54	5.75	4.46	4.56	3.67	3.61	3.57	3.00	3.93	4.14	4.07
6	4.92	5.24	4.90	4.39	4.39	3.52	3.71	3.49	3.05	4.30	4.12	3.79
7	4.77	5.21	5.00	4.46	4.29	3.47	3.71	3.54	3.00	4.30	4.09	3.79
8	4.67	4.96	5.10	4.56	4.24	3.82	3.56	3.47	3.05	4.03	4.09	3.89
9	4.62	5.14	5.85	5.06	4.14	3.82	3.46	3.47	3.10	3.95	4.02	4.07
10	4.59	5.01	7.70	5.56	4.04	3.72	3.39	3.37	3.42	3.88	3.99	4.14
11	4.57	4.71	6.90	5.46	3.84	3.57	3.41	3.57	3.35	3.80	3.97	3.94
12	4.55	4.76	6.45	5.22	3.92	3.47	3.31	3.92	3.18	5.05	3.97	3.99
13	4.72	4.56	6.65	4.99	3.89	3.37	3.23	3.72	3.40	5.12	3.97	4.14
14	4.97	4.36	6.57	4.84	3.84	3.39	3.21	3.55	3.32	4.65	3.97	4.19
15	4.67	4.28	5.98	4.74	3.84	3.47	3.13	3.47	3.30	4.45	3.89	4.39
16	4.32	4.21	5.60	4.64	3.84	3.47	3.13	3.42	3.25	4.30	3.92	4.49
17	4.25	4.44	6.67	4.54	3.74	3.92	3.11	3.35	3.25	4.18	3.89	6.74
18	4.22	4.34	6.40	4.52	3.64	3.67	3.11	3.27	3.28	4.10	3.79	7.64
19	4.22	4.28	5.65	4.44	3.69	3.47	3.09	3.27	3.10	4.10	3.79	6.59
20	4.15	4.31	5.15	4.34	3.74	3.49	3.21	3.22	3.15	4.05	3.77	4.07
21	4.15	4.34	5.25	4.29	3.76	3.47	4.16	3.17	3.12	4.00	3.72	5.59
22	5.85	4.81	5.17	4.24	3.62	3.72	4.71	3.22	3.25	3.90	3.69	7.84
23	6.52	4.81	5.07	4.16	3.62	3.57	4.66	3.17	3.17	3.90	3.69	8.14
24	5.12	4.86	4.95	4.09	3.54	3.47	4.11	3.17	3.23	3.80	3.72	7.09
25	4.72	4.66	4.80	3.99	3.54	3.37	4.19	3.22	3.05	3.85	3.72	5.04
26	4.60	4.81	4.70	3.99	4.14	3.47	4.11	3.12	3.58	3.82	3.79	5.69
27	4.97	5.84	4.65	4.06	4.09	3.37	4.06	3.07	3.70	3.80	4.04	5.49
28	4.97	7.06	4.50	4.02	4.52	3.27	3.91	3.07	3.70	4.75	3.97	5.14
29	4.92	.....	4.80	3.94	4.16	3.32	3.81	3.02	4.90	5.53	3.89	5.02
30	5.02	.....	5.35	4.76	3.96	4.05	4.21	3.02	4.85	5.03	3.79	4.99
31	4.92	.....	5.00	.....	3.84	.....	3.96	2.97	.....	4.65	.....	4.86

Mean daily gage height, in feet, of Fishkill Creek at Glenham, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.74	4.83	8.33	5.25	3.88	3.38	6.63	4.26	5.53	3.78	4.48	.....
2	4.67	4.68	6.43	4.93	3.78	3.35	5.86	3.98	5.08	3.78	4.36	.....
3	5.04	5.00	5.73	4.78	3.78	3.28	5.23	3.78	4.90	3.78	4.28	.....
4	5.77	5.20	5.40	4.85	3.83	3.28	4.93	3.88	4.78	3.76	4.28	.....
5	5.34	6.10	5.25	5.20	3.80	3.25	4.68	4.63	4.58	3.70	4.28	.....
6	5.04	5.88	5.18	4.85	3.75	3.18	4.68	4.98	4.58	3.68	4.28	.....
7	4.87	5.35	4.98	4.73	3.68	3.15	4.58	5.78	4.46	3.68	4.20	.....
8	4.79	4.91	5.03	5.03	3.63	3.35	4.20	6.18	4.28	3.70	.....	.....
9	4.81	4.91	5.93	5.95	3.58	3.83	4.18	5.33	4.18	9.58	.....	.....
10	4.97	4.75	5.93	5.95	3.53	3.63	4.08	4.93	4.18	11.63	.....	.....
11	5.04	4.68	5.68	5.50	3.55	3.73	3.98	4.68	4.18	8.33	.....	.....
12	5.29	5.40	5.70	5.20	3.48	3.83	3.98	4.58	4.08	7.28	.....	.....
13	5.14	5.43	5.40	5.00	3.48	3.95	3.98	4.50	3.98	6.53	.....	.....
14	5.32	5.15	5.20	4.90	3.48	4.18	4.08	4.30	3.90	6.18	.....	.....
15	5.29	4.88	5.08	4.95	3.80	4.80	3.96	4.18	3.88	5.73	.....	.....
16	4.89	4.78	4.95	4.90	3.63	5.60	3.78	4.08	3.88	5.58	.....	.....
17	4.59	4.46	4.85	4.78	3.48	5.43	3.78	4.08	4.88	5.48	.....	.....
18	4.39	4.38	4.73	4.65	3.48	4.96	3.78	4.08	5.08	5.53	.....	.....
19	4.27	4.43	4.68	4.50	3.40	4.78	3.96	3.98	4.68	5.53	.....	.....
20	4.64	4.45	4.58	4.45	3.43	4.80	3.88	4.23	4.38	5.18	.....	.....
21	4.89	4.46	4.50	4.38	3.35	5.38	3.93	4.36	4.28	4.98	.....	.....
22	9.39	4.53	4.93	4.18	3.33	6.46	3.88	4.20	4.18	4.88	.....	.....
23	5.37	4.53	5.63	4.23	3.25	6.53	4.28	4.08	4.13	4.83	.....	.....
24	4.72	4.41	7.23	4.20	3.18	6.18	4.28	3.86	4.00	5.10	.....	.....
25	5.12	4.36	6.58	4.18	3.20	5.96	3.88	3.96	3.96	4.93	.....	.....
26	5.07	4.30	5.98	4.10	3.28	5.53	3.83	4.68	3.88	4.73	.....	.....
27	4.69	4.18	5.63	4.05	3.23	5.16	3.78	4.40	3.88	4.58	.....	.....
28	4.54	5.78	5.38	3.98	3.28	4.78	3.63	4.33	3.88	4.53	.....	.....
29	5.24	.....	5.18	3.95	4.08	5.13	3.56	4.78	3.88	4.48	.....	.....
30	5.49	.....	5.05	3.88	3.63	6.28	4.23	5.33	3.78	4.48	.....	.....
31	5.27	.....	5.30	.....	3.50	.....	4.56	5.98	.....	4.48	.....	.....

Rating table for Fishkill Creek at Glenham, N. Y., from March 1, 1902, to November 7, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	22	4.90	568	7.30	2,310	9.70	4,480
2.60	28	5.00	615	7.40	2,390	9.80	4,590
2.70	33	5.10	676	7.50	2,470	9.90	4,690
2.80	38	5.20	737	7.60	2,550	10.00	4,800
2.90	44	5.30	798	7.70	2,630	10.10	4,920
3.00	50	5.40	859	7.80	2,710	10.20	5,040
3.10	60	5.50	920	7.90	2,790	10.30	5,170
3.20	70	5.60	992	8.00	2,870	10.40	5,290
3.30	80	5.70	1,060	8.10	2,950	10.50	5,410
3.40	90	5.80	1,140	8.20	3,030	10.60	5,530
3.50	100	5.90	1,210	8.30	3,110	10.70	5,650
3.60	124	6.00	1,280	8.40	3,190	10.80	5,780
3.70	148	6.10	1,360	8.50	3,270	10.90	5,900
3.80	172	6.20	1,440	8.60	3,360	11.00	6,020
3.90	196	6.30	1,510	8.70	3,460	11.10	6,170
4.00	220	6.40	1,590	8.80	3,550	11.20	6,320
4.10	252	6.50	1,670	8.90	3,650	11.30	6,460
4.20	284	6.60	1,750	9.00	3,740	11.40	6,610
4.30	316	6.70	1,830	9.10	3,850	11.50	6,760
4.40	348	6.80	1,910	9.20	3,950	11.60	6,910
4.50	380	6.90	1,990	9.30	4,060	11.70	7,060
4.60	427	7.00	2,070	9.40	4,160	11.80	7,200
4.70	474	7.10	2,150	9.50	4,270	11.90	7,350
4.80	521	7.20	2,230	9.60	4,380	12.00	7,500

Logarithmic extension above 7 feet. Open section.

Mean daily discharge, in second-feet, of Fishkill Creek at Glenham, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	134	351	157	137	124
2	.....	.....	.....	.....	.....	.....	.....	117	361	137	134	[a] 93
3	.....	.....	.....	.....	.....	.....	.....	111	305	174	134	[a] 103
4	.....	.....	.....	.....	.....	.....	.....	98	285	174	134	[a] 109
5	.....	.....	.....	.....	.....	.....	.....	95	243	140	127	[a] 114
6	.....	.....	.....	.....	.....	.....	.....	95	192	130	127	[a] 144
7	.....	.....	.....	.....	.....	.....	.....	409	202	127	130	[a] 150
8	.....	.....	.....	.....	.....	.....	127	876	174	124	134	[a] 130
9	.....	.....	.....	.....	.....	.....	127	448	167	121	127	[a] 103
10	.....	.....	.....	.....	.....	.....	114	261	147	121	124	414
11	.....	.....	.....	.....	.....	.....	111	181	157	121	124	731
12	.....	.....	.....	.....	.....	.....	117	167	271	114	130	463
13	.....	.....	.....	.....	.....	.....	114	147	250	114	250	351
14	.....	.....	.....	.....	.....	.....	104	127	192	243	202	390
15	.....	.....	.....	.....	.....	.....	101	127	174	482	157	793
16	.....	.....	.....	.....	.....	.....	95	117	226	468	140	2,185
17	.....	.....	.....	.....	.....	.....	104	121	192	337	134	1,364
18	.....	.....	.....	.....	.....	.....	216	601	216	278	134	846
19	.....	.....	.....	.....	.....	.....	140	409	181	250	134	629
20	.....	.....	.....	.....	.....	.....	127	278	147	216	134	535
21	.....	.....	.....	.....	.....	.....	111	295	147	209	131	438
22	.....	.....	.....	.....	.....	.....	101	531	140	192	131	414
23	.....	.....	.....	.....	.....	.....	95	371	130	181	127	414
24	.....	.....	.....	.....	.....	.....	95	409	127	174	127	327
25	.....	.....	.....	.....	.....	.....	95	1,515	124	157	261	351
26	.....	.....	.....	.....	.....	.....	91	1,630	121	140	254	327
27	.....	.....	.....	.....	.....	.....	88	951	114	140	185	472
28	.....	.....	.....	.....	.....	.....	75	668	124	140	150	629
29	.....	.....	.....	.....	.....	.....	85	482	134	140	140	424
30	.....	.....	.....	.....	.....	.....	261	409	209	140	137	[b] 3,000
31	.....	.....	.....	.....	.....	.....	192	351	.....	137	.....	[b] 2,330

[a] River frozen. [b] Estimated.

Mean daily discharge, in second-feet, of Fishkill Creek at Glenham, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1,230	345	[b]13,700	544	874	172	148	190	50	332	380	177
2	1,670	265	[b]4,300	486	544	142	106	166	44	316	348	218
3	821	598	3,480	438	451	118	95	142	55	252	316	214
4	708	564	1,790	404	451	142	184	142	40	202	300	260
5	640	579	1,100	364	404	142	124	118	50	202	268	244
6	[a]332	454	568	348	348	106	148	100	55	316	260	172
7	285	442	615	364	316	98	148	112	50	316	252	172
8	253	345	676	404	300	178	112	98	55	228	252	196
9	237	414	1,170	645	268	178	95	98	60	208	228	111
10	228	361	2,630	956	236	154	90	87	92	190	220	126
11	222	265	1,990	890	184	118	90	118	85	172	214	91
12	216	282	1,630	752	202	98	81	202	68	645	214	96
13	268	219	1,790	615	196	87	72	154	90	691	214	126
14	348	170	1,730	544	184	90	71	112	82	451	214	136
15	253	154	1,230	498	184	98	62	100	80	364	196	176
16	162	140	992	450	184	98	62	92	75	316	202	198
17	148	187	1,810	404	160	202	60	85	75	276	196	1,240
18	142	166	1,590	392	136	142	60	77	77	252	172	2,590
19	142	154	1,030	364	148	98	59	77	60	252	172	1,750
20	128	160	706	332	160	100	70	72	65	236	166	244
21	128	166	768	316	160	98	268	68	62	220	154	992
22	728	297	722	300	130	154	474	72	75	196	148	2,750
23	1,130	297	661	268	130	118	451	68	68	196	148	2,990
24	623	314	592	252	112	98	252	68	72	172	154	2,150
25	419	250	521	220	112	87	284	72	55	184	154	645
26	361	297	474	220	268	98	252	62	118	178	172	1,060
27	540	723	451	236	252	87	236	58	148	172	236	920
28	540	2,096	380	228	392	77	196	58	148	498	214	706
29	332	.....	521	208	268	82	172	52	568	938	192	630
30	365	.....	828	498	208	236	284	52	544	630	172	615
31	332	.....	615	.....	184	.....	208	48	.....	451	.....	544

[a] Taken from ice curve January 6 to 28, inclusive; January 29 to February 28, inclusive; December 9 to 17, inclusive.
[b] Estimated at Groverville Dam.

Mean daily discharge, in second-feet, of Fishkill Creek at Glenham, N. Y., etc.—Continued.

Days.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	498	532	3,130	768	190	87	1,770	300	938	166	372	.....
2	462	462	1,610	580	166	85	1,170	202	661	166	332	.....
3	645	615	1,080	509	166	77	752	166	568	166	308	.....
4	1,120	737	859	544	178	77	580	190	509	160	308	.....
5	828	1,360	768	737	172	75	462	438	415	148	308	.....
6	645	1,190	722	544	160	68	462	603	415	142	308	.....
7	556	828	603	486	142	65	415	1,120	364	142	[b] 284	.....
8	521	568	630	630	130	85	284	1,420	308	148	.....	.....
9	[a] 297	568	1,230	1,240	118	178	276	813	276	4,690	.....	.....
10	348	498	1,230	1,240	106	130	244	580	276	6,910	.....	.....
11	373	462	1,050	920	112	154	214	462	276	3,130	.....	.....
12	474	859	1,060	737	98	178	214	415	244	2,290	.....	.....
13	414	874	859	615	98	208	214	380	214	1,690	.....	.....
14	486	706	737	568	98	276	244	316	196	1,420	.....	.....
15	474	556	661	592	172	521	208	276	190	1,080	.....	.....
16	223	509	592	568	130	992	166	244	190	974	.....	.....
17	228	365	544	509	98	904	166	244	556	904	.....	.....
18	176	340	486	451	98	592	166	244	661	938	.....	.....
19	152	356	462	380	90	509	208	214	462	938	.....	.....
20	243	364	415	364	92	521	190	292	340	722	.....	.....
21	223	364	380	340	85	844	202	332	308	603	.....	.....
22	1,025	392	580	276	82	1,630	190	284	276	556	.....	.....
23	507	392	1,010	292	75	1,690	308	244	260	532	.....	.....
24	268	348	2,250	284	68	1,420	308	184	220	676	.....	.....
25	406	332	1,690	276	70	1,240	190	208	208	580	.....	.....
26	386	316	1,230	252	77	938	178	462	190	486	.....	.....
27	474	276	1,010	236	72	706	166	348	190	415	.....	.....
28	404	1,120	844	214	77	509	130	324	190	392	.....	.....
29	768	.....	722	208	244	691	112	509	190	372	.....	.....
30	920	.....	645	190	130	1,490	292	813	166	372	.....	.....
31	782	.....	798	.....	100	.....	404	1,260	.....	372	.....	.....

[a] Taken from ice curve January 9 to 26, inclusive.

[b] End of record.

Estimated monthly discharge of Fishkill Creek at Glenham, N. Y., for 1901–1903.

[Drainage area, 198 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1901.						
July	261	75	120	0.606	0.70	8.05
August	1,630	95	404	2.040	2.35	8.58
September	361	114	193	.975	1.09	4.54
October	482	114	186	.939	1.08	3.28
November	261	124	150	.758	.85	2.22
December	3,000	93	610	3.081	3.55	7.74
1902.						
January	1,670	128	449	2.267	2.61	.....
February	2,096	140	382	1.929	2.00	.....
March	13,700	380	1,647	8.317	9.59	.....
April	956	208	431	2.206	2.47	.....
May	874	112	262	1.323	1.52	.....
June	236	77	123	.621	.69	.....
July	474	59	162	.818	.94	.....
August	202	48	97	.490	.56	.....
September	568	40	106	.535	.60	.....
October	938	174	324	1.636	1.89	.....
November	380	148	218	1.101	1.23	.....
December	2,990	91	726	3.666	4.22	.....
The year	13,700	40	411	2.076	28.32	.....
1903.						
January	1,120	152	494	2.494	2.87	.....
February	1,360	276	581	2.934	3.04	.....
March	3,130	380	964	4.868	5.60	.....
April	1,240	190	518	2.616	2.92	.....
May	244	68	119	.601	.69	.....
June	1,690	65	564	2.848	3.17	.....
July	1,770	112	351	1.772	2.04	.....
August	1,420	166	448	2.262	2.61	.....
September	938	166	342	1.727	1.92	.....
October	6,910	142	751	1.772	2.04	.....
November 1–7	372	284	317	1.600	1.79	.....

WAPPINGER CREEK NEAR WAPPINGER FALLS, N. Y.

The drainage basin of this creek comprises a hilly plateau, 400 to 500 feet above sea level. The area is nearly rectangular in shape, and includes numerous small lakes and marshes. The run-off is drained from the numerous hills, which dot the area, through numerous winding brooks. At a point about 16 miles above the mouth of the stream the basin becomes narrower and more nearly level. The stream flows near the right of a valley 3 to 4 miles in width. It descends gradually to Wappinger Falls, at which point it makes a sudden descent to an elevation of a few feet above sea level. The elevation of Wappinger Pond is 78 feet.

The gaging station was established May 19, 1903, at the first highway bridge above Wappinger Falls, N. Y. The vertical gage is attached to the central pier. It is read twice each day by Lee Jackson. Discharge measurements are made from the two-span bridge to which the gage is attached. The spans have lengths of 43 and 46 feet. The channel is straight for 250 feet above and for 300 feet below the bridge. The bed of the stream is composed of sand and gravel with a few bowlders. The drainage area above the gaging station is 194 square miles. At the junction of the east and west branches of the creek, the drainage area is 141 square miles, and above the mouth of the creek it is 216 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Wappinger Creek near Wappinger Falls, N. Y., in 1903.

Date.	Hydrograper.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 19	E. P. Roundey	0.60	62
June 16	F. H. Tillinghast	4.50	1,368
July 7	do	1.70	317
July 27	E. P. Roundey	.80	127
August 1	do	1.10	166
Do	do	1.10	169
September 3	F. H. Tillinghast	2.35	567
September 17	E. P. Roundey	1.50	305

Mean daily gage height, in feet, of Wappinger Creek near Wappinger Falls, N. Y., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.55	3.25	1.35	2.95	0.70	1.30	1.30
2	.....	.50	2.80	1.20	2.60	.70	1.30	1.55
3	.....	.50	2.35	1.05	2.25	.65	1.20	1.30
4	.....	.35	2.05	1.00	2.10	.70	1.20	1.10
5	.....	.45	1.95	2.60	1.90	.70	1.20	1.65
6	.....	.45	1.80	2.95	1.75	.70	1.30	1.35
7	.....	.35	1.75	4.70	1.55	.70	1.30	1.30
8	.....	.65	1.70	2.85	1.50	2.00	1.30	1.25
9	.....	.90	1.55	2.25	1.40	7.35	1.25	1.20
10	.....	.75	1.35	2.00	1.30	7.75	1.35	1.20
11	.....	1.05	1.15	1.70	1.20	5.35	1.40	1.25
12	.....	4.20	1.10	1.60	1.20	4.40	1.30	1.20
13	.....	3.95	1.10	1.55	1.20	3.60	1.15	1.05
14	.....	2.80	1.10	1.45	1.20	3.10	1.10	1.45
15	.....	3.15	1.10	1.30	1.20	2.75	1.00	1.50
16	.....	4.40	1.10	1.30	1.20	2.45	1.20	1.50
17	.....	3.55	1.00	1.30	1.35	2.30	2.15	1.50
18	.....	3.00	1.00	1.30	1.75	2.70	2.75	1.50
19	0.60	2.60	1.10	1.25	1.50	2.35	2.15	1.50
20	.55	2.60	1.10	1.30	1.10	2.10	1.85	1.75
21	.50	4.60	1.45	1.25	1.00	2.00	1.65	4.10
22	.50	5.70	1.50	1.15	1.00	1.90	1.50	7.25
23	.50	4.30	1.90	1.05	1.00	1.85	1.50	7.35
24	.45	4.20	1.25	.90	.95	2.10	1.50	5.80
25	.50	3.65	1.15	1.20	.75	1.95	1.50	4.55
26	.40	3.20	1.10	1.60	.70	1.70	1.40	4.10
27	.35	2.80	.95	1.50	.70	1.60	1.30	3.15
28	.55	2.35	.75	1.55	.90	1.55	1.15	2.45
29	1.25	2.55	.80	1.70	.85	1.50	1.70	2.25
30	1.25	4.55	1.95	2.35	.70	1.50	1.10	2.20
31	.65	.....	1.50	3.15	.....	1.40	.....	2.20

WALLKILL RIVER AT NEWPALTZ, N. Y.

This station was established July 7, 1901, at the highway bridge at Newpaltz, N. Y., and was discontinued November 10, 1903. Gage heights were read twice each day. The channel at this station is straight and the bed is permanent. The gaging section is deep and the water sluggish at low stages. At both high and low water the conditions are not favorable for accurate measurement. The records and computations for the three years during which the station was maintained are given herewith. The gage heights and discharge measurements have been revised and reduced to a common datum. A record has been kept of the thickness and condition of the ice during periods when the stream was frozen over, and discharge measurements have been made and a rating table has been prepared, which is applicable only to the frozen section. On July 16, 1903, the old wire gage was replaced by a standard chain gage which was installed by F. H. Tillinghast. The length of the chain from the end of the weight to the marker is 30.38 feet.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Wallkill River at Newpaltz, N. Y., for 1901–1903.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.	
1901.		*Feet.*	*Feet.*	*Second-feet.*
July 7	R. E. Horton and G. B. Hollister.	7.19	7.19	824
July 8	do	7.25	7.25	843
July 19	A. E. Place	8.23	8.21	1,243
July 23	do	6.20	6.18	306
August 7	do	14.85	14.79	7,365
August 13	do	7.85	7.79	1,037
August 20	do	10.00	9.90	2,729
August 28	do	10.60	10.50	2,982
August 31	do	9.07	8.97	1,917
September 5	do	8.90	8.80	1,676
September 19	do	7.73	7.63	1,076
October 1	W. W. Schlecht	7.36	7.26	896
October 9	do	6.48	6.38	398
October 11	do	6.30	6.20	340
October 24	do	6.33	6.23	333
November 9	do	5.94	5.84	178
November 16	do	6.50	6.40	402
November 27	do	7.52	7.42	1,022
December 11	do	11.50	11.40	[a]3,040
December 19	do	13.70	13.60	[b]3,277

[a] Ice 0.7 foot. [b] Ice.

Discharge measurements of Wallkill River at Newpaltz, N. Y., etc.—Continued.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.	
1902.		*Feet.*	*Feet.*	*Second-feet.*
January 21	W. W. Schlecht	7.24	7.14	[a] 332
January 23	do	17.33	17.23	[b] 6,063
January 31	do	9.07	8.97	[c] 1,167
February 10	do	7.78	7.68	597
February 24	do	7.33	7.23	[c] 288
March 11	do	15.93	15.83	[d] 7,140
April 9	do	13.21	13.11	5,354
April 21	do	7.57	7.47	1,028
April 26	do	6.92	6.82	680
May 1	do	10.26	10.16	2,623
May 13	do	6.68	6.58	506
May 21	do	6.33	6.23	344
June 6	do	6.40	6.30	381
June 19	do	6.18	6.08	295
July 16	H. K. Barrows	5.70	5.60	124
July 29	do	7.49	7.39	942
August 6	do	7.98	7.88	1,150
August 15	do	6.72	6.62	518
August 28	do	5.86	5.76	169
September 18	H. K. Barrows and P. M. Churchill.	5.96	5.86	210
November 4	F. H. Tillinghast	7.95	7.85	1,165
November 18	do	6.62	6.52	550
December 2	do	6.80	6.70	626
1903.				
January 7	F. H. Tillinghast	11.20	11.10	[e] 2,293
February 10	do	10.90	10.80	2,028
February 26	do	8.85	8.75	[f] 945
March 4	do	15.85	15.75	[g] 5,985
March 9	do	13.25	13.15	[d] 5,398
March 24	do	14.95	14.85	6,821
April 9	do	12.65	12.55	4,858
May 12	do	6.28	6.18	370
May 21	do	5.85	5.75	107

[a] Ice 1.0 to 1.4 feet thick.
[b] Ice 0.7 to 1.4 feet thick.
[c] Ice 1 to 2 feet thick.
[d] No ice.
[e] Ice 0.7 to 0.8 foot thick.
[f] Ice 0.6 to 1.2 feet thick.
[g] Ice above and below station.

Mean daily gage height, in feet, of Wallkill River at Newpaltz, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	6.00	9.10	7.35	5.90	6.15
2	.....	.....	.....	.....	.....	.....	.....	5.80	9.75	7.15	5.90	5.95
3	.....	.....	.....	.....	.....	.....	.....	5.87	9.65	7.05	5.90	5.90
4	.....	.....	.....	.....	.....	.....	.....	5.90	9.25	6.90	5.90	6.10
5	.....	.....	.....	.....	.....	.....	.....	6.35	8.45	6.85	5.95	6.25
6	.....	.....	.....	.....	.....	.....	.....	6.35	8.25	6.75	6.00	6.55
7	.....	.....	.....	.....	.....	.....	7.28	11.95	7.95	6.55	5.90	6.50
8	.....	.....	.....	.....	.....	.....	7.22	11.15	7.60	6.37	5.85	7.20
9	.....	.....	.....	.....	.....	.....	6.92	9.20	7.32	6.25	5.75	9.90
10	.....	.....	.....	.....	.....	.....	6.65	9.05	7.35	6.20	5.65	12.20
11	.....	.....	.....	.....	.....	.....	6.52	9.00	7.15	6.20	5.55	11.60
12	.....	.....	.....	.....	.....	.....	7.32	7.95	6.95	6.10	5.85	10.20
13	.....	.....	.....	.....	.....	.....	7.60	7.60	7.05	6.10	6.30	9.95
14	.....	.....	.....	.....	.....	.....	7.15	7.05	6.85	6.25	6.90	10.50
15	.....	.....	.....	.....	.....	.....	6.85	7.30	6.55	7.40	6.80	13.20
16	.....	.....	.....	.....	.....	.....	6.55	7.00	6.65	7.75	6.45	12.75
17	.....	.....	.....	.....	.....	.....	6.37	6.65	6.95	7.40	6.15	13.00
18	.....	.....	.....	.....	.....	.....	7.15	9.15	7.52	7.18	5.95	13.55
19	.....	.....	.....	.....	.....	.....	7.96	11.05	7.55	7.05	6.05	13.65
20	.....	.....	.....	.....	.....	.....	7.18	10.05	7.35	6.85	6.25	12.85
21	.....	.....	.....	.....	.....	.....	6.48	10.15	7.20	6.60	7.20	11.60
22	.....	.....	.....	.....	.....	.....	6.33	10.15	7.00	6.35	8.00	10.60
23	.....	.....	.....	.....	.....	.....	6.23	10.05	6.85	6.22	8.55	10.35
24	.....	.....	.....	.....	.....	.....	6.03	9.60	6.72	6.20	8.25	10.05
25	.....	.....	.....	.....	.....	.....	5.98	14.20	6.55	6.10	8.00	9.45
26	.....	.....	.....	.....	.....	.....	5.98	11.90	6.40	6.02	7.35	8.90
27	.....	.....	.....	.....	.....	.....	5.83	11.15	6.25	6.00	6.85	9.15
28	.....	.....	.....	.....	.....	.....	5.83	10.50	6.25	6.00	6.75	9.60
29	.....	.....	.....	.....	.....	.....	5.83	10.00	6.55	6.00	6.55	11.70
30	.....	.....	.....	.....	.....	.....	5.78	9.80	7.15	6.00	6.35	19.15
31	.....	.....	.....	.....	.....	.....	5.98	9.05	.....	6.40	.....	19.10

Mean daily gage height, in feet, of Wallkill River at Newpaltz, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	[a]15.05	8.65	23.42	9.25	10.15	7.40	7.15	9.40	6.00	10.15	8.55	6.70
2	13.00	8.65	23.70	8.85	8.85	7.15	7.05	9.00	5.95	10.75	8.25	6.60
3	12.85	10.55	24.55	8.55	9.05	6.95	7.70	8.65	5.90	10.05	8.05	7.40
4	12.00	9.60	22.65	8.10	8.75	6.80	7.48	8.50	5.78	9.55	7.85	7.85
5	10.35	9.65	20.15	7.90	8.25	6.45	6.98	8.20	5.68	9.50	7.55	8.00
6	10.60	8.80	15.10	9.60	7.85	6.25	6.68	7.85	5.60	10.00	7.40	8.45
7	10.10	8.05	13.10	7.60	7.40	6.20	6.42	7.75	5.50	9.35	7.40	8.00
8	9.60	7.75	12.60	8.30	7.35	6.15	6.25	7.55	5.40	8.90	7.55	7.60
9	9.05	7.68	14.80	13.55	7.25	6.20	6.12	7.20	5.40	8.45	7.05	7.60
10	8.75	7.60	16.35	13.40	7.00	6.40	6.00	6.95	6.00	8.05	6.85	7.55
11	8.65	7.45	15.80	12.10	6.70	6.25	5.90	6.80	6.35	8.15	6.65	[b]7.50
12	8.10	7.45	16.00	11.55	6.55	6.20	5.90	6.70	6.20	12.85	6.60	7.50
13	7.95	7.30	16.95	10.55	6.50	6.10	5.80	6.65	6.25	11.80	6.50	7.45
14	7.95	7.25	16.40	9.70	6.45	6.05	5.68	6.58	6.35	10.40	6.50	7.40
15	7.90	7.05	14.90	9.25	6.40	6.00	5.60	6.50	6.15	9.60	6.50	7.40
16	7.90	7.00	14.55	8.55	6.35	6.10	5.60	6.42	6.05	9.25	6.40	7.40
17	7.60	7.10	15.30	8.10	6.50	6.15	5.62	6.32	5.95	8.90	6.40	12.10
18	7.45	7.05	13.65	7.90	6.20	6.05	5.48	6.28	5.85	8.50	6.40	12.15
19	7.40	6.98	11.65	7.75	6.20	6.02	5.45	6.18	5.70	8.50	6.40	12.20
20	7.10	6.90	10.50	7.50	6.20	6.00	6.00	6.10	5.80	8.05	6.40	12.20
21	7.10	6.95	10.20	7.35	6.20	6.02	7.40	6.20	5.80	7.70	6.30	12.85
22	18.40	6.95	10.10	7.25	6.20	6.22	8.55	6.00	5.80	7.55	6.30	18.90
23	17.55	7.00	9.65	7.05	6.15	6.30	7.30	5.95	5.80	7.38	6.55	19.55
24	13.45	7.15	9.50	7.00	6.10	6.25	10.60	6.00	5.80	7.23	6.20	17.10
25	13.05	7.20	9.35	6.85	6.10	6.10	13.90	5.95	6.05	7.05	6.20	16.15
26	12.10	7.65	8.90	6.75	6.35	6.10	9.00	5.90	9.55	6.85	6.25	15.40
27	12.75	11.30	8.40	6.90	8.20	6.00	8.40	5.90	11.90	6.75	7.25	14.10
28	12.55	[a]12.65	8.10	6.35	9.10	5.92	7.70	5.85	11.80	11.55	7.25	14.10
29	11.05	.....	10.10	6.55	8.30	6.02	7.35	8.15	13.35	11.15	7.00	13.70
30	9.40	.....	10.95	11.65	8.20	6.90	7.35	7.15	10.25	9.35	6.85	13.20
31	9.15	.....	9.80	.....	7.80	.....	8.35	6.30	.....	8.85	.....	11.65

[a] River frozen January 1 to February 28, inclusive.
[b] River frozen December 11, 1902, to March 5, 1903, inclusive.

Mean daily gage height, in feet, of Wallkill River at Newpaltz, N. Y., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	11.60	11.70	20.63	9.85	6.85	5.70	12.20	6.60	11.40	6.10	6.80	.....
2	11.50	11.90	18.05	9.20	6.65	5.65	11.05	6.35	10.00	6.10	6.80	.....
3	12.40	14.10	15.95	8.90	6.55	5.70	10.55	6.40	8.00	6.10	6.75	.....
4	13.15	13.45	15.55	9.25	6.50	5.65	9.75	6.80	7.85	6.10	6.60	.....
5	12.65	14.60	a13.90	9.30	6.50	5.60	9.40	13.80	8.00	6.10	6.80	.....
6	11.65	12.80	10.85	8.65	6.45	5.55	8.90	12.50	8.25	6.10	6.80	.....
7	11.00	12.00	10.50	8.40	6.40	5.55	8.50	15.45	7.85	6.35	6.80	.....
8	10.60	11.60	10.45	10.35	6.40	5.65	8.10	13.00	7.55	18.60	6.80	.....
9	10.10	11.30	12.30	13.10	6.30	6.05	7.75	.....	7.35	22.50	6.50	.....
10	9.65	11.05	12.45	11.35	6.20	6.30	7.40	.....	7.10	20.80	6.50	.....
11	9.30	11.70	12.70	9.95	6.10	6.55	7.15	.....	7.00	21.30	a6.50	.....
12	9.10	16.45	11.40	9.50	6.10	11.15	6.95	.....	7.00	20.35	.....	.....
13	9.00	16.05	10.10	9.15	6.05	12.45	6.80	.....	6.85	19.25	.....	.....
14	9.15	14.30	9.30	8.80	6.05	11.15	6.70	.....	6.55	16.75	.....	.....
15	9.00	13.45	9.00	11.60	6.05	15.30	6.55	.....	6.40	13.60	.....	.....
16	9.00	12.70	8.75	13.45	6.10	14.90	6.58	6.70	7.00	12.50	.....	.....
17	8.75	12.50	8.70	12.20	6.05	12.60	6.50	7.45	8.75	11.15	.....	.....
18	8.60	12.30	8.55	11.45	6.05	11.60	6.55	7.20	8.30	10.90	.....	.....
19	8.45	12.20	8.25	10.70	5.95	11.05	6.95	7.10	7.45	9.85	.....	.....
20	8.30	9.85	8.05	9.95	5.90	.....	7.20	7.15	7.35	9.35	.....	.....
21	8.75	9.70	8.00	9.30	5.80	15.90	7.55	7.20	7.25	8.95	.....	.....
22	10.45	9.45	10.60	8.80	5.80	14.65	7.40	7.10	7.10	8.65	.....	.....
23	10.60	9.25	12.90	8.40	5.85	13.10	9.60	6.90	7.05	8.35	.....	.....
24	9.80	9.25	15.00	8.15	5.85	14.70	8.95	6.85	6.75	8.15	.....	.....
25	9.20	8.95	12.60	7.70	5.75	13.25	8.65	7.10	6.55	7.85	.....	.....
26	8.80	8.75	11.40	7.65	5.70	12.05	8.90	7.50	6.35	7.65	.....	.....
27	8.70	8.65	10.60	7.45	5.70	10.95	8.15	6.90	6.25	7.55	.....	.....
28	9.10	13.00	10.00	7.30	5.75	10.05	6.70	6.90	6.25	7.40	.....	.....
29	10.35	.....	9.35	7.15	5.85	11.00	6.65	14.90	6.30	7.15	.....	.....
30	10.60	.....	8.80	6.95	5.85	13.85	7.75	14.40	6.15	7.00	.....	.....
31	11.00	.....	10.35	.....	5.75	.....	7.05	13.25	.....	6.85	.....	.....

a End of record.

Rating table for Wallkill River at Newpaltz, N. Y., for open section, from July 7, 1901, to November 11, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.50	105	7.45	973	9.40	2,206	12.70	4,856
5.55	120	7.50	1,000	9.45	2,240	12.80	4,944
5.60	136	7.55	1,029	9.50	2,275	12.90	5,032
5.65	152	7.60	1,058	9.55	2,310	13.00	5,120
5.70	167	7.65	1,087	9.60	2,346	13.10	5,210
5.75	182	7.70	1,116	9.65	2,381	13.20	5,300
5.80	198	7.75	1,145	9.70	2,417	13.30	5,390
5.85	214	7.80	1,174	9.75	2,452	13.40	5,480
5.90	229	7.85	1,203	9.80	2,488	13.50	5,570
5.95	244	7.90	1,232	9.85	2,523	13.60	5,660
6.00	260	7.95	1,261	9.90	2,559	13.70	5,750
6.05	282	8.00	1,290	9.95	2,594	13.80	5,840
6.10	304	8.05	1,321	10.00	2,630	13.90	5,930
6.15	325	8.10	1,352	10.10	2,706	14.00	6,020
6.20	347	8.15	1,383	10.20	2,782	14.10	6,110
6.25	369	8.20	1,414	10.30	2,858	14.20	6,200
6.30	391	8.25	1,445	10.40	2,934	14.30	6,290
6.35	413	8.30	1,476	10.50	3,010	14.40	6,380
6.40	434	8.35	1,507	10.60	3,090	14.50	6,470
6.45	456	8.40	1,538	10.70	3,170	14.60	6,564
6.50	478	8.45	1,569	10.80	3,250	14.70	6,658
6.55	503	8.50	1,600	10.90	3,330	14.80	6,752
6.60	528	8.55	1,633	11.00	3,410	14.90	6,846
6.65	554	8.60	1,666	11.10	3,494	15.00	6,940
6.70	579	8.65	1,699	11.20	3,576	15.10	7,034
6.75	604	8.70	1,732	11.30	3,662	15.20	7,128
6.80	629	8.75	1,765	11.40	3,746	15.30	7,222
6.85	654	8.80	1,798	11.50	3,830	15.40	7,316
6.90	680	8.85	1,831	11.60	3,914	15.50	7,410
6.95	705	8.90	1,864	11.70	3,998	15.60	7,506
7.00	730	8.95	1,897	11.80	4,082	15.70	7,602
7.05	757	9.00	1,930	11.90	4,166	15.80	7,698
7.10	784	9.05	1,964	12.00	4,250	15.90	7,794
7.15	811	9.10	1,999	12.10	4,336	16.00	7,890
7.20	838	9.15	2,033	12.20	4,422	16.10	7,992
7.25	865	9.20	2,068	12.30	4,508	16.20	8,094
7.30	892	9.25	2,102	12.40	4,594	16.30	8,196
7.35	919	9.30	2,137	12.50	4,680	16.40	8,298
7.40	946	9.35	2,171	12.60	4,768	16.50	8,400

Rating table for Wallkill River at Newpaltz, N. Y., for open section, from July 7, 1901, to November 11, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
16.60	8,506	19.00	11,650	21.40	16,280	23.80	21,880
16.70	8,612	19.10	11,840	21.50	16,500	23.90	22,140
16.80	8,718	19.20	12,030	21.60	16,720	24.00	22,400
16.90	8,824	19.30	12,220	21.70	16,940	24.10	22,660
17.00	8,930	19.40	12,410	21.80	17,160	24.20	22,920
17.10	9,034	19.50	12,600	21.90	17,380	24.30	23,180
17.20	9,138	19.60	12,780	22.00	17,600	24.40	23,440
17.30	9,242	19.70	12,960	22.10	17,820	24.50	23,700
17.40	9,346	19.80	13,140	22.20	18,040	24.60	23,960
17.50	9,450	19.90	13,320	22.30	18,260	24.70	24,220
17.60	9,560	20.00	13,500	22.40	18,480	24.80	24,480
17.70	9,670	20.10	13,690	22.50	18,700	24.90	24,740
17.80	9,780	20.20	13,880	22.60	18,920	25.00	25,000
17.90	9,890	20.30	14,070	22.70	19,140	25.10	25,290
18.00	[a]10,000	20.40	14,260	22.80	19,360	25.20	25,580
18.10	10,180	20.50	14,450	22.90	19,580	25.30	25,870
18.20	10,360	20.60	14,640	23.00	19,800	25.40	26,160
18.30	10,540	20.70	14,830	23.10	20,060	25.50	26,450
18.40	10,720	20.80	15,020	23.20	20,320	25.60	26,740
18.50	10,900	20.90	15,210	23.30	20,580	25.70	27,030
18.60	11,050	21.00	15,400	23.40	20,840	25.80	27,320
18.70	11,200	21.10	15,620	23.50	21,100	25.90	27,610
18.80	11,350	21.20	15,840	23.60	21,360	26.00	27,900
18.90	11,500	21.30	16,060	23.70	21,620		

[a] Logarithmic extension above 18 feet gage height.

Rating table for Wallkill River at Newpaltz, N. Y., for average ice conditions from July 7, 1901, to November 11, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.50	90	8.45	849	10.40	1,921	12.35	3,158
6.55	106	8.50	872	10.45	1,951	12.40	3,190
6.60	121	8.55	898	10.50	1,980	12.45	3,223
6.65	137	8.60	923	10.55	2,011	12.50	3,255
6.70	152	8.65	949	10.60	2,042	12.55	3,289
6.75	168	8.70	974	10.65	2,073	12.60	3,322
6.80	183	8.75	1,000	10.70	2,104	12.65	3,356
6.85	199	8.80	1,026	10.75	2,135	12.70	3,389
6.90	214	8.85	1,052	10.80	2,166	12.75	3,423
6.95	230	8.90	1,077	10.85	2,197	12.80	3,456
7.00	245	8.95	1,103	10.90	2,228	12.85	3,490
7.05	263	9.00	1,128	10.95	2,259	12.90	3,523
7.10	281	9.05	1,155	11.00	2,290	12.95	3,557
7.15	299	9.10	1,181	11.05	2,321	13.00	3,590
7.20	317	9.15	1,208	11.10	2,353	13.05	3,623
7.25	335	9.20	1,235	11.15	2,385	13.10	3,656
7.30	353	9.25	1,262	11.20	2,416	13.15	3,689
7.35	371	9.30	1,288	11.25	2,448	13.20	3,722
7.40	389	9.35	1,315	11.30	2,479	13.25	3,755
7.45	407	9.40	1,342	11.35	2,511	13.30	3,788
7.50	425	9.45	1,369	11.40	2,542	13.35	3,821
7.55	447	9.50	1,395	11.45	2,574	13.40	3,854
7.60	469	9.55	1,424	11.50	2,605	13.45	3,887
7.65	491	9.60	1,453	11.55	2,637	13.50	3,920
7.70	513	9.65	1,482	11.60	2,669	13.55	3,954
7.75	535	9.70	1,511	11.65	2,702	13.60	3,988
7.80	557	9.75	1,540	11.70	2,734	13.65	4,022
7.85	579	9.80	1,569	11.75	2,766	13.70	4,056
7.90	601	9.85	1,598	11.80	2,798	13.75	4,090
7.95	623	9.90	1,627	11.85	2,831	13.80	4,124
8.00	645	9.95	1,656	11.90	2,863	13.85	4,158
8.05	668	10.00	1,685	11.95	2,896	13.90	4,192
8.10	690	10.05	1,715	12.00	2,928	13.95	4,226
8.15	713	10.10	1,744	12.05	2,961	14.00	4,260
8.20	735	10.15	1,774	12.10	2,993	14.05	4,294
8.25	758	10.20	1,803	12.15	3,026	14.10	4,328
8.30	781	10.25	1,833	12.20	3,059	14.15	4,362
8.35	804	10.30	1,862	12.25	3,092	14.20	4,396
8.40	826	10.35	1,892	12.30	3,125	14.25	4,430

Rating table for Wallkill River at Newpaltz, N. Y., for average ice conditions from July 7, 1901, to November 11, 1903—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
14.30	4,464	15.15	5,042	16.50	5,972	18.10	7,080
14.35	4,498	15.20	5,076	16.60	6,042	18.20	7,160
14.40	4,532	15.25	5,111	16.70	6,113	18.30	7,240
14.45	4,566	15.30	5,145	16.80	6,184	18.40	7,320
14.50	4,600	15.35	5,180	16.90	6,254	18.50	7,400
14.55	4,634	15.40	5,214	17.00	6,325	18.60	7,475
14.60	4,668	15.45	5,248	17.10	6,395	18.70	7,550
14.65	4,702	15.50	5,282	17.20	6,465	18.80	7,625
14.70	4,736	15.60	5,351	17.30	6,535	18.90	7,700
14.75	4,770	15.70	5,421	17.40	6,605	19.00	7,775
14.80	4,804	15.80	5,491	17.50	6,675	19.50	8,130
14.85	4,838	15.90	5,560	17.60	6,740	20.00	8,550
14.90	4,872	16.00	5,630	17.70	6,805	20.50	8,900
14.95	4,906	16.10	5,698	17.80	6,870	20.60	8,982
15.00	4,940	16.20	5,766	17.90	6,935	20.70	9,064
15.05	4,974	16.30	5,835	18.00	7,000	21.00	9,311
15.10	5,008	16.40	5,903				

Mean daily discharge, in second-feet, of Wallkill River at Newpaltz, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	260	1,999	919	229	325
2	.....	.....	.....	.....	.....	.....	.....	198	2,453	811	229	245
3	.....	.....	.....	.....	.....	.....	.....	223	2,382	757	229	229
4	.....	.....	.....	.....	.....	.....	.....	229	2,003	680	229	304
5	.....	.....	.....	.....	.....	.....	.....	413	1,569	654	245	369
6	.....	.....	.....	.....	.....	.....	.....	413	1,445	604	260	503
7	.....	.....	.....	.....	.....	.....	881	4,208	1,261	503	229	478
8	.....	.....	.....	.....	.....	.....	854	3,535	1,058	420	214	838
9	.....	.....	.....	.....	.....	.....	689	2,068	903	369	183	2,559
10	.....	.....	.....	.....	.....	.....	554	1,964	919	347	152	4,422
11	.....	.....	.....	.....	.....	.....	488	1,930	811	347	121	3,914
12	.....	.....	.....	.....	.....	.....	902	1,261	705	304	214	2,782
13	.....	.....	.....	.....	.....	.....	1,058	1,058	757	304	391	2,595
14	.....	.....	.....	.....	.....	.....	811	757	654	369	680	3,010
15	.....	.....	.....	.....	.....	.....	654	892	503	946	629	5,300
16	.....	.....	.....	.....	.....	.....	503	730	554	1,145	456	4,900
17	.....	.....	.....	.....	.....	.....	420	554	705	946	325	5,120
18	.....	.....	.....	.....	.....	.....	811	2,034	1,012	828	245	5,615
19	.....	.....	.....	.....	.....	.....	1,267	3,452	1,029	757	282	5,705
20	.....	.....	.....	.....	.....	.....	820	2,668	919	654	369	4,988
21	.....	.....	.....	.....	.....	.....	469	2,744	838	528	838	3,914
22	.....	.....	.....	.....	.....	.....	404	2,744	730	413	1,290	3,090
23	.....	.....	.....	.....	.....	.....	360	2,668	654	356	1,633	2,896
24	.....	.....	.....	.....	.....	.....	273	2,346	589	347	1,445	2,668
25	.....	.....	.....	.....	.....	.....	254	6,200	503	304	1,290	2,241
26	.....	.....	.....	.....	.....	.....	254	4,166	434	269	919	1,864
27	.....	.....	.....	.....	.....	.....	207	3,535	369	260	654	2,034
28	.....	.....	.....	.....	.....	.....	207	3,010	369	260	604	2,346
29	.....	.....	.....	.....	.....	.....	207	2,630	503	260	503	3,998
30	.....	.....	.....	.....	.....	.....	192	2,488	811	260	413	11,935
31	.....	.....	.....	.....	.....	.....	238	1,965	.....	434	.....	11,840
Mean	.....	.....	.....	.....	.....	.....	551	2,043	981	528	517	3,323

Mean daily discharge, in second-feet, of Wallkill River at Newpaltz, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	a4,974	a 949	20,892	2,102	2,744	946	811	2,206	260	2,744	1,633	579
2	a3,590	a 949	21,620	1,831	1,831	811	757	1,930	245	3,210	1,445	528
3	a3,490	a2,011	23,830	1,633	1,965	705	1,116	1,699	229	2,668	1,321	946
4	a2,928	a1,453	19,080	1,352	1,765	629	989	1,600	192	2,311	1,208	1,208
5	a1,892	a1,482	13,785	1,232	1,445	456	720	1,414	161	2,275	1,029	1,290
6	a2,042	a1,026	7,034	2,346	1,208	369	569	1,203	136	2,630	946	1,569
7	a1,744	a 668	5,210	1,058	946	347	443	1,145	105	2,172	946	1,290
8	a1,453	a 535	4,768	1,476	919	325	369	1,029	70	1,864	1,029	1,058
9	a1,155	a 504	6,752	5,615	865	347	312	838	70	1,569	757	1,058
10	a1,000	a 469	8,247	5,480	730	434	260	705	260	1,321	654	1,029
11	a 949	a 407	7,698	4,336	579	369	229	629	413	1,383	554	a 425
12	a 690	a 407	7,890	3,872	508	347	229	579	347	4,988	528	a 425
13	a 623	a 353	8,877	3,050	478	304	198	554	369	4,082	478	a 407
14	a 623	a 335	8,298	2,417	456	282	161	518	413	2,984	478	a 389
15	a 601	a 263	6,846	2,102	434	260	136	478	325	2,346	478	a 389
16	a 601	a 245	6,517	1,633	413	304	136	443	282	2,102	434	a 389
17	a 469	a 281	7,222	1,352	478	325	142	400	245	1,864	434	a 2,993
18	a 407	a 263	5,705	1,232	347	282	100	382	214	1,600	434	a 3,026
19	a 389	a 239	3,956	1,145	347	269	90	339	167	1,600	434	a 3,059
20	a 281	a 214	3,010	1,000	347	260	260	304	198	1,321	434	a 3,059
21	a 281	a 230	2,782	919	347	269	946	347	198	1,116	391	a 3,490
22	a7,320	a 230	2,706	865	347	356	1,633	260	198	1,029	391	a 7,700
23	a6,707	a 245	2,382	757	325	391	892	245	198	935	503	a 8,160
24	a3,887	a 299	2,275	730	304	369	3,090	260	198	854	347	a 6,395
25	a3,623	a 317	2,172	654	304	304	5,930	245	282	757	347	a 5,732
26	a2,993	a 491	1,864	604	413	304	1,930	229	2,311	654	369	a 5,214
27	a3,428	a2,479	1,538	680	1,414	260	1,538	229	4,166	604	865	a 4,328
28	a3,289	a3,356	1,352	413	1,999	235	1,116	214	4,082	3,872	865	a 4,328
29	a2,321	.....	2,706	503	1,476	269	919	1,383	5,435	3,535	730	a 4,056
30	a1,342	.....	3,370	3,960	1,414	680	919	811	2,820	2,172	654	a 3,722
31	a1,208	.....	2,488	.....	1,174	.....	1,507	391	.....	1,831	.....	a 2,702
Mean	a2,139	a 739	7,188	1,878	913	394	918	742	820	2,076	704	2,611

a Taken from ice curve.

Mean daily discharge, in second-feet, of Wallkill River at Newpaltz, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	[a]2,669	[a]2,734	[a]9,007	2,524	654	167	4,422	528	3,746	304	629	.....
2	[a]2,605	[a]2,863	[a]7,040	2,068	554	152	3,452	413	2,630	304	629	.....
3	[a]3,190	[a]4,328	[a]5,595	1,864	503	167	3,050	434	1,290	304	604	.....
4	[a]3,699	[a]3,887	[a]5,316	2,003	478	152	2,452	629	1,203	304	528	.....
5	[a]3,356	[a]4,668	[a]4,192	2,137	478	136	2,206	5,840	1,290	304	629	.....
6	[a]2,702	[a]3,456	3,290	1,699	456	121	1,864	4,680	1,445	304	629	.....
7	[a]2,290	[a]2,928	3,010	1,538	434	121	1,600	7,363	1,203	412	629	.....
8	[a]2,042	[a]2,669	2,972	2,896	434	152	1,352	5,120	1,029	11,050	629	.....
9	[a]1,744	[a]2,479	4,508	5,210	391	282	1,145	.....	919	18,700	478	.....
10	[a]1,482	[a]2,321	4,637	3,704	347	391	946	.....	784	15,020	478	.....
11	[a]1,288	[a]2,734	4,856	2,595	304	508	811	.....	730	16,060	478	.....
12	[a]1,181	[a]5,937	3,746	2,275	304	3,535	705	.....	730	14,160	.....	.....
13	[a]1,128	[a]5,664	2,706	2,034	282	4,637	629	.....	654	12,120	.....	.....
14	[a]1,208	[a]4,464	2,137	1,798	282	3,535	579	.....	503	8,660	.....	.....
15	[a]1,128	[a]3,887	1,930	3,914	282	7,222	503	.....	434	5,660	.....	.....
16	[a]1,128	[a]3,389	1,765	5,525	304	6,846	518	579	730	4,680	.....	.....
17	[a]1,000	[a]3,255	1,732	4,422	282	4,768	478	973	1,765	3,540	.....	.....
18	[a]923	[a]3,125	1,633	3,788	282	3,914	503	838	1,476	3,330	.....	.....
19	[a]849	[a]3,059	1,445	3,170	245	3,452	705	784	973	2,520	.....	.....
20	[a]781	[a]1,598	1,321	2,595	229	.....	838	811	919	2,170	.....	.....
21	[a]1,000	[a]1,511	1,290	2,137	198	7,794	1,029	838	865	1,900	.....	.....
22	[a]1,951	[a]1,369	3,090	1,798	198	6,611	946	784	784	1,700	.....	.....
23	[a]2,042	[a]1,262	5,032	1,538	214	5,210	2,346	680	757	1,510	.....	.....
24	[a]1,569	[a]1,262	6,940	1,383	214	6,658	1,897	654	604	1,380	.....	.....
25	[a]1,235	[a]1,103	4,768	1,116	183	5,345	1,699	784	503	1,200	.....	.....
26	[a]1,026	[a]1,000	3,746	1,087	167	4,293	1,864	1,000	413	1,090	.....	.....
27	[a]974	[a]949	3,090	973	167	3,370	1,383	680	369	1,030	.....	.....
28	[a]1,181	[a]3,590	2,630	892	183	2,668	579	680	369	946	.....	.....
29	[a]1,892	.....	2,172	811	214	3,410	554	6,846	390	811	.....	.....
30	[a]2,042	.....	1,798	705	214	5,885	1,145	6,380	325	730	.....	.....
31	[a]2,290	.....	2,896	.....	183	.....	757	5,345	.....	654	.....	.....
Mean	[a]1,729	[a]2,910	2,558	2,340	312	3,155	1,386	2,236	1,091	4,286	577	.....

[a] Taken from ice curve.

Estimated monthly discharge of Wallkill River at Newpaltz, N. Y., for 1901–1903.

[Drainage area, 736 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1901.					
July 7–31	1,267	192	551	0.749	0.86
August	6,200	198	2,043	2.778	3.21
September	2,453	369	981	1.334	1.48
October	1,145	260	528	.718	.83
November	1,633	121	517	.703	.78
December	11,935	229	3,323	4.519	5.21
1902.					
January	7,320	281	2,139	2.909	3.35
February	3,356	214	739	1.005	1.05
March	23,830	1,352	7,188	9.776	11.27
April	5,615	413	1,878	2.554	2.85
May	2,744	304	913	1.242	1.43
June	946	235	394	.536	.60
July	5,930	90	918	1.248	1.44
August	2,206	214	742	1.009	1.16
September	5,435	70	820	1.115	1.25
October	4,988	604	2,076	2.823	3.25
November	1,633	347	704	.957	1.07
December	8,160	389	2,611	3.551	4.09
The year	23,830	70	1,760	2.394	32.81
1903.					
January	3,689	781	1,729	2.351	2.71
February	5,937	949	2,910	3.958	4.12
March	9,007	1,290	2,558	3.479	4.01
April	5,525	705	2,340	3.182	3.55
May	654	167	312	.424	.48
June	7,794	121	3,155	4.291	4.79
July	4,422	478	1,386	1.885	2.18
August	7,363	413	2,236	3.041	3.50
September	3,746	325	1,091	1.484	1.65
October	18,700	304	4,286	5.828	6.70
November 1 to 11, inclusive	629	478	577	.784	.87

DELAWARE AND HUDSON CANAL AT CREEKLOCKS, N. Y.

The Delaware and Hudson Canal runs parallel to Rondout Creek from the feeder dam below High Falls to tide water at Eddyville. The canal receives its entire water supply from Rondout Creek. The section from High Falls to Eddyville is the only portion of the canal remaining in operation in New York State. At Rosendale the canal carries a portion of the yield of Rondout Creek past the gaging station. In order to determine the run-off from Rondout Creek drainage basin, gaging of the flow in the Delaware and Hudson Canal at the foot of the Rosendale level have been undertaken. The diversion to the canal added to the measured discharge of Rondout gaging station represents the total flow from the drainage basin.

The discharge in the canal was determined from observations of the depth of flow over the waste weir, of the number of lockages, and of the opening in the lock gates.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Delaware and Hudson Canal at Rosendale, N. Y., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	8.1	19.9	15.3	16.8	16.6	16.1	19.4
2	.....	7.9	19.4	14.6	18.1	.....	19.1	20.9
3	.....	8.1	.....	15.1	16.8	17.1	18.1	20.9
4	.....	15.6	20.2	14.6	15.3	20.7	20.9	.....
5	.....	.....	19.1	15.8	.....	16.6	19.9	19.4
6	.....	15.3	17.8	18.4	15.8	19.2	.....	20.9
7	.....	18.4	18.4	.....	13.6	18.4	15.3	18.6
8	.....	18.6	17.6	18.9	15.3	17.8	15.6	16.3
9	.....	20.4	17.8	18.6	16.8	.....	20.9	15.3
10	.....	149.4	.....	15.3	17.3	20.9	19.4	(a)
11	.....	19.4	18.4	15.5	16.1	19.7	19.4	.....
12	.....	.....	19.4	19.6	.....	19.1	19.7	.....
13	.....	20.7	19.1	19.6	17.3	17.8	.....	.....
14	.....	20.2	19.9	.....	18.9	18.1	18.6	.....
15	.....	16.1	16.8	17.0	16.9	19.7	17.1	.....
16	.....	20.7	18.4	18.1	17.3	.....	17.8	.....
17	.....	19.4	.....	16.6	13.8	16.6	19.9	.....
18	.....	17.8	18.4	16.3	17.8	22.2	18.1	.....
19	.....	.....	17.8	14.8	.....	19.4	19.9	.....
20	6.2	22.3	16.8	18.4	18.4	18.1	.....	.....
21	6.0	20.7	18.6	.....	17.6	18.6	18.9	.....
22	.....	21.2	17.6	19.6	19.1	17.1	19.2	.....
23	3.2	19.4	17.6	16.8	17.1	.....	19.1	.....
24	5.2	20.7	.....	9.7	16.6	17.3	18.9	.....
25	5.4	20.4	11.7	13.8	19.2	18.1	18.9	10.0
26	4.4	.....	13.4	16.1	.....	14.3	18.6	15.3
27	4.8	20.7	18.1	18.1	19.1	19.4	.....	14.3
28	5.9	19.6	13.1	.....	18.6	17.6	19.9	17.4
29	.....	19.2	14.8	13.8	18.9	14.1	18.9	17.6
30	5.9	19.7	16.1	16.1	21.4	.....	19.4	(b)
31	8.7	.....	.....	.....	19.4	18.7	.....	.....
Mean	5.6	23.0	17.6	16.4	17.4	18.2	18.8	16.2

a Canal injured by flood. No record from October 10 to 21, inclusive. b Canal closed for season.

Estimated monthly mean diversion from Rondout Creek to feed Delaware and Hudson Canal at Creek Locks, N. Y.

Month.	Discharge in second-feet.		
	1901.	1902.	1903.
March		[a] 18.0	[b] 5.6
April		22.5	23.0
May		24.0	17.6
June		23.7	16.4
July		23.8	17.4
August		24.3	18.2
September		24.0	18.8
October	20	22.2	16.2
November	19	18.2	
December		[c] 21.8	

[a] March 23 to 31. [b] March 20 to 31. [c] December 1 to 6.

RONDOUT CREEK AT ROSENDALE, N. Y.

This station was established July 6, 1901, at the highway bridge at Rosendale, and was discontinued November 7, 1903. The Delaware and Hudson Canal, now abandoned above High Falls, draws its water supply for the section from High Falls to Eddyville from Rondout Creek at the feeder dam above Rosendale. The flow in the canal is therefore to be added to that at the gaging station to obtain the total run-off from the drainage area above this point. During the three years in which the station was maintained, gage readings were made twice each day by means of a chain gage supported by outriggers fastened to the floor beams near the center of the downstream side of the bridge. Discharge measurements were made from the bridge, except at low water, when they were made by wading at a ford 1 mile downstream. The bridge has a single span of 136 feet. The bed of the channel is composed of rock. The entire discharge, with the exception of the diversion into the Delaware and Hudson Canal, passes under the highway bridge at all stages. The bench mark is a circle cut in the upstream corner of the bridge seat on the right abutment. Its elevation is 32.03 feet above gage datum. The records for the three years during which the station was maintained have been corrected to reduce them to a common gage datum and are published on the following pages.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Rondout Creek at Rosendale, N. Y., in 1901–1903.

Date.	Hydrographer	Gage heights.		Discharge.
		Original reading.	Corrected reading.[a]	
1901.		*Feet.*	*Feet.*	*Second-feet.*
July 6	R. E. Horton and G. B. Hollister.	6.55	6.55	319
July 18	A. E. Place	6.30	6.29	118
August 6	do	6.40	[b]6.36	99
August 8	do	7.50	7.46	745
August 15	do	6.55	6.51	225
August 20	do	6.94	6.90	526
August 28	do	7.15	7.11	645
September 3	do	7.80	7.73	1,200
September 4	do	7.55	7.48	836
September 7	do	6.90	6.83	427
September 24	W. W. Schlecht	6.45	6.38	140
October 7	do	6.60	6.50	218
October 11	do	6.47	6.37	163
Do	G. B. Hollister	6.47	6.37	201
October 18	W. W. Schlecht	7.03	6.93	510
November 7	do	6.42	6.29	138
November 16	do	6.55	6.42	183
November 26	do	7.21	7.08	676
December 6	do	6.80	6.63	[c]222
December 12	do	8.00	7.83	1,491
December 21	do	7.60	7.43	[d]772
December 30	do	11.95	11.78	5,353

[a] Correction due to change in length of gage wire.
[b] Wading.
[c] Ice 3 inches thick.
[d] Ice along banks.

Discharge measurements of Rondout Creek at Rosendale, N. Y., in 1901–1903—Continued.

Date.	Hydrographer.	Gage heights.		Discharge.
		Original reading.	Corrected reading.	
1902.		*Feet.*	*Feet.*	*Second-feet.*
January 7	W. W. Schlecht	7.31	7.14	710
January 14	do	7.00	6.83	[a] 423
January 25	do	7.83	7.66	1,371
January 30	do	8.17	8.00	[b] 943
February 8	do	8.81	8.61	[c] 1,185
February 18	do	7.70	7.50	342
February 26	do	8.13	7.93	[d] 543
Do	do	8.43	8.23	[d] 684
March 1	do	17.60	[e] 17.38	13,936
March 21	do	8.07	7.85	1,529
April 10	do	11.78	11.60	5,665
April 28	do	6.83	6.65	382
May 12	do	6.85	6.70	421
June 6	do	6.38	6.27	163
June 20	do	6.42	6.31	166
July 15	H. K. Barrows	6.33	6.26	142
July 18	do	6.33	6.26	137
July 29	do	7.40	7.36	888
August 7	do	7.39	7.39	838
August 21	do	6.33	[f] 6.33	.....
August 29	do	6.33	6.33	145
September 25	P. M. Churchill	6.31	6.37	167
November 4	F. H. Tillinghast	7.00	7.06	570
November 21	do	6.55	6.61	283
December 2	do	6.70	6.76	367
December 17	do	12.80	[g] 12.86	7,928
1903.				
January 8	F. H. Tillinghast	7.65	[h] 7.71	1,122
February 3	do	10.10	10.16	2,358
February 23	do	8.50	8.56	.....
February 25	do	7.90	7.96	[i] 676
March 4	do	8.25	8.31	1,818
March 9	do	10.55	10.61	4,638
April 9	do	9.15	9.21	2,895
May 20	do	6.12	6.19	95

[a] Ice and slush.
[b] Ice on banks.
[c] Ice 0.06 to 0.2 inch thick.
[d] Ice.
[e] Made by floats. Course = 37 feet.
[f] Not complete gaging.
[g] Gage repaired.
[h] Ice along banks. Not reliable.
[i] Ice, 0.5 foot thick. Anchor ice.

Mean daily gage height, in feet, of Rondout Creek, at Rosendale, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	6.71	7.55	7.16	6.37	6.38
2	.....	.....	.....	.....	.....	.....	.....	6.46	7.68	6.75	6.37	6.23
3	.....	.....	.....	.....	.....	.....	.....	6.26	7.73	6.85	6.37	6.33
4	.....	.....	.....	.....	.....	.....	.....	6.21	7.54	6.70	6.32	6.68
5	.....	.....	.....	.....	.....	.....	.....	6.13	7.35	6.60	6.27	6.70
6	.....	.....	.....	.....	.....	.....	.....	6.31	6.90	6.52	6.27	6.68
7	.....	.....	.....	.....	.....	.....	.....	9.71	6.80	6.45	6.27	6.75
8	.....	.....	.....	.....	.....	.....	6.49	7.31	6.70	6.45	6.27	6.83
9	.....	.....	.....	.....	.....	.....	6.39	6.88	6.60	6.42	6.27	7.03
10	.....	.....	.....	.....	.....	.....	6.24	6.58	6.53	6.35	6.27	9.03
11	.....	.....	.....	.....	.....	.....	6.19	7.13	6.53	6.32	6.24	9.08
12	.....	.....	.....	.....	.....	.....	6.24	7.38	6.58	6.32	6.32	8.05
13	.....	.....	.....	.....	.....	.....	6.29	6.83	6.65	6.40	6.82	7.58
14	.....	.....	.....	.....	.....	.....	6.32	6.51	6.50	7.15	6.67	8.80
15	.....	.....	.....	.....	.....	.....	6.29	6.46	6.43	7.62	6.49	16.58
16	.....	.....	.....	.....	.....	.....	6.37	6.48	6.55	7.27	6.47	10.43
17	.....	.....	.....	.....	.....	.....	6.29	6.46	6.60	7.00	6.42	8.78
18	.....	.....	.....	.....	.....	.....	6.84	6.71	6.98	6.90	6.42	8.23
19	.....	.....	.....	.....	.....	.....	6.54	7.26	6.78	6.80	6.42	7.60
20	.....	.....	.....	.....	.....	.....	6.47	6.91	6.58	6.70	6.37	7.38
21	.....	.....	.....	.....	.....	.....	6.46	8.71	6.48	6.62	6.27	7.38
22	.....	.....	.....	.....	.....	.....	6.36	8.11	6.45	6.60	6.22	7.40
23	.....	.....	.....	.....	.....	.....	6.39	7.46	6.40	6.60	6.27	7.78
24	.....	.....	.....	.....	.....	.....	6.34	8.96	6.35	6.50	6.37	7.58
25	.....	.....	.....	.....	.....	.....	6.34	9.36	6.33	6.50	7.47	7.05
26	.....	.....	.....	.....	.....	.....	6.29	8.06	6.28	6.50	7.12	6.95
27	.....	.....	.....	.....	.....	.....	6.46	7.43	6.25	6.50	6.84	6.83
28	.....	.....	.....	.....	.....	.....	6.41	7.11	6.23	6.55	6.74	7.18
29	.....	.....	.....	.....	.....	.....	6.36	6.91	6.98	6.40	6.67	8.93
30	.....	.....	.....	.....	.....	.....	6.66	7.38	7.34	6.40	6.67	11.95
31	.....	.....	.....	.....	.....	.....	6.71	6.68	.....	6.40	.....	9.83

Mean daily gage height, in feet, of Rondout Creek at Rosendale, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	8.55	8.78	16.98	8.00	8.10	6.46	7.00	7.70	6.31	10.14	7.31	6.79
2	7.73	8.75	18.93	7.67	7.55	6.36	6.83	8.35	6.26	9.34	7.19	6.76
3	7.73	a9.55	11.98	7.40	7.55	6.44	6.90	7.60	6.19	8.49	7.09	6.96
4	7.73	9.15	9.53	7.40	7.60	6.51	7.63	7.28	6.21	7.96	7.06	7.26
5	7.73	9.50	8.48	7.17	7.35	6.36	7.13	7.08	6.16	7.86	6.96	6.94
6	7.65	9.05	7.83	7.08	7.17	6.29	7.06	7.25	6.24	8.84	6.94	6.86
7	7.40	8.80	7.73	7.42	7.12	6.36	6.93	7.33	6.26	8.06	7.01	7.01
8	a7.10	8.62	7.43	7.92	7.00	6.34	6.81	7.03	6.26	7.71	6.91	7.04
9	6.95	8.37	9.18	12.07	6.87	6.36	6.78	6.93	6.29	7.44	6.86	6.94
10	6.91	7.85	9.48	11.22	6.77	6.26	6.61	6.83	7.06	7.24	6.84	7.16
11	6.93	7.97	9.08	9.57	6.72	6.19	6.51	6.80	6.64	7.01	6.79	a7.14
12	7.18	7.85	9.48	8.97	6.72	6.24	6.46	6.90	6.46	9.81	6.79	7.06
13	6.78	7.78	10.83	8.30	6.67	6.24	6.43	6.80	6.51	8.71	6.79	7.01
14	6.55	7.67	9.93	7.97	6.52	6.26	6.38	6.70	6.74	8.06	6.76	7.21
15	6.65	7.60	8.93	7.67	6.47	6.24	6.28	6.55	6.54	7.64	6.76	7.56
16	6.73	7.45	8.58	7.47	6.55	6.24	6.33	6.58	6.41	7.41	6.76	8.41
17	6.60	7.32	12.88	7.32	6.45	6.39	6.26	6.50	6.31	7.29	6.71	13.01
18	6.53	7.40	9.73	7.20	6.47	6.34	6.23	6.45	6.26	7.19	6.71	10.06
19	6.60	7.15	8.43	7.07	6.45	6.19	6.26	6.40	6.24	7.14	6.74	8.86
20	6.53	7.22	8.03	6.94	6.45	6.32	7.46	6.40	6.31	7.09	6.71	8.36
21	6.55	7.22	7.85	6.92	6.42	6.32	8.73	6.38	6.56	7.01	6.71	8.41
22	14.63	7.20	7.78	6.87	6.35	6.99	9.11	6.48	6.46	6.96	6.71	13.51
23	9.66	7.22	7.66	6.82	6.32	6.59	8.31	6.40	6.29	6.86	6.66	10.64
24	8.18	7.27	7.58	6.72	6.30	6.39	10.98	6.40	6.31	6.86	6.66	9.61
25	7.68	7.35	7.40	6.70	6.25	6.29	10.18	6.33	6.51	6.86	6.61	8.56
26	7.50	8.02	7.23	6.79	6.65	6.32	8.88	6.30	9.46	6.79	6.76	8.16
27	9.24	a10.47	7.16	6.77	6.72	6.39	8.16	6.28	9.81	6.69	6.81	8.93
28	7.58	13.77	7.10	6.64	7.05	6.32	7.73	6.25	8.74	9.81	6.96	7.51
29	7.83	.....	9.76	6.59	6.70	6.34	7.31	6.33	15.19	8.66	6.94	7.33
30	8.00	.....	9.31	9.19	6.45	7.59	7.73	6.30	10.11	7.89	6.86	7.26
31	8.43	.....	8.41	.....	6.48	.....	7.26	6.30	.....	7.51	.....	7.26

a River frozen January 8 to 27, inclusive; February 3 to 24, inclusive; February 27 to 28, inclusive; December 11 to 15, inclusive.

Mean daily gage height, in feet, of Rondout Creek at Rosendale, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	7.19	10.01	12.49	8.16	6.57	6.07	8.36	6.43	9.14	6.40	6.92	.....
2	7.21	9.76	9.48	7.71	6.52	6.05	7.62	6.31	8.32	6.35	6.90	.....
3	7.66	10.31	8.73	7.57	6.49	6.02	7.14	6.25	7.80	6.35	6.88	.....
4	8.71	10.02	8.33	7.82	6.52	6.07	6.96	6.51	7.50	6.35	6.90	.....
5	8.18	9.86	8.38	7.64	6.57	6.23	6.80	11.26	7.28	6.35	6.88	.....
6	7.66	8.56	8.21	7.41	6.52	5.98	6.66	9.46	7.08	6.35	7.05	.....
7	7.31	8.06	8.14	7.31	6.47	5.92	6.63	9.83	6.88	6.40	6.92	.....
8	7.56	7.71	8.91	7.91	6.47	5.92	6.45	8.58	6.85	6.40	.....	.....
9	7.21	7.51	10.76	9.12	6.42	6.48	6.35	8.10	6.80	19.43	.....	.....
10	7.29	7.26	9.86	8.39	6.37	6.27	6.36	7.65	6.80	19.20	.....	.....
11	7.41	7.31	10.96	7.92	6.37	6.33	6.30	7.00	6.78	10.68	.....	.....
12	7.86	10.01	9.92	7.68	6.33	11.42	6.30	7.20	6.68	9.35	.....	.....
13	8.26	9.01	9.09	7.48	6.32	9.73	6.28	6.91	6.62	8.65	.....	.....
14	8.76	8.66	8.61	7.43	6.27	8.17	6.25	6.76	6.60	8.10	.....	.....
15	8.86	8.01	8.26	8.56	6.29	9.59	6.23	6.65	6.55	7.85	.....	.....
16	8.91	7.81	8.01	8.33	6.32	8.97	6.22	6.65	6.50	7.65	.....	.....
17	[a]8.21	[a]8.66	7.77	7.83	6.27	7.99	6.30	6.75	6.70	7.70	.....	.....
18	7.76	9.91	7.64	7.51	6.22	7.77	6.30	6.61	8.00	8.28	.....	.....
19	7.31	9.78	7.48	7.31	6.22	7.45	6.88	6.70	7.00	7.80	.....	.....
20	7.31	9.67	7.39	7.18	6.18	7.77	6.70	7.13	6.80	7.58	.....	.....
21	8.06	9.51	7.38	7.01	6.17	11.57	7.70	7.00	6.70	7.40	.....	.....
22	9.36	9.31	9.19	6.96	6.17	10.32	6.75	6.70	6.60	7.28	.....	.....
23	8.21	8.56	10.89	6.96	6.12	9.35	7.86	6.55	6.55	7.22	.....	.....
24	7.71	8.46	11.86	6.88	6.07	10.77	7.05	6.50	6.45	7.30	.....	.....
25	7.91	8.01	9.67	6.81	6.09	9.37	6.56	6.85	6.42	7.15	.....	.....
26	8.01	7.66	8.66	6.76	6.12	8.52	6.46	7.53	6.40	7.12	.....	.....
27	7.91	7.46	8.19	6.71	6.12	7.89	6.36	6.92	6.40	7.02	.....	.....
28	7.71	11.18	7.86	6.66	6.09	7.42	6.26	6.95	6.40	7.00	.....	.....
29	8.46	.....	7.61	6.61	6.17	7.82	6.21	14.36	6.35	6.98	.....	.....
30	9.96	.....	7.47	6.56	6.12	9.01	6.63	11.74	6.40	6.95	.....	.....
31	10.51	.....	9.19	.....	6.07	.....	6.58	10.76	.....	6.98	.....	.....

[a] River frozen January 17 to 30, inclusive; February 17 to 28, inclusive.

Rating table for Rondout Creek at Rosendale, N. Y., for open section, from July 8, 1901, to November 7, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.00	50	8.10	1,578	10.20	3,943	13.50	8,353
6.05	68	8.15	1,630	10.25	4,003	13.60	8,496
6.10	86	8.20	1,683	10.30	4,064	13.70	8,640
6.15	103	8.25	1,736	10.35	4,125	13.80	8,783
6.20	121	8.30	1,789	10.40	4,186	13.90	8,927
6.25	139	8.35	1,842	10.45	4,247	14.00	9,070
6.30	157	8.40	1,894	10.50	4,308	14.10	9,216
6.35	175	8.45	1,947	10.55	4,369	14.20	9,362
6.40	192	8.50	2,000	10.60	4,430	14.30	9,508
6.45	210	8.55	2,054	10.65	4,491	14.40	9,654
6.50	228	8.60	2,108	10.70	4,552	14.50	9,800
6.55	259	8.65	2,162	10.75	4,614	14.60	9,946
6.60	290	8.70	2,216	10.80	4,675	14.70	10,092
6.65	322	8.75	2,270	10.85	4,737	14.80	10,238
6.70	353	8.80	2,323	10.90	4,798	14.90	10,384
6.75	384	8.85	2,377	10.95	4,859	15.00	10,530
6.80	415	8.90	2,431	11.00	4,920	15.10	10,678
6.85	446	8.95	2,485	11.05	4,985	15.20	10,826
6.90	478	9.00	2,539	11.10	5,050	15.30	10,974
6.95	509	9.05	2,595	11.20	5,180	15.40	11,122
7.00	540	9.10	2,652	11.30	5,310	15.50	11,270
7.05	583	9.15	2,708	11.40	5,440	15.60	11,419
7.10	626	9.20	2,764	11.50	5,570	15.70	11,568
7.15	669	9.25	2,820	11.60	5,706	15.80	11,717
7.20	712	9.30	2,877	11.70	5,842	15.90	11,866
7.25	756	9.35	2,933	11.80	5,978	16.00	12,015
7.30	799	9.40	2,984	11.90	6,114	16.10	12,168
7.35	842	9.45	3,046	12.00	6,250	16.20	12,321
7.40	885	9.50	3,102	12.10	6,387	16.30	12,474
7.45	928	9.55	3,162	12.20	6,524	16.40	12,627
7.50	971	9.60	3,222	12.30	6,661	16.50	12,780
7.55	1,021	9.65	3,286	12.40	6,798	16.60	12,934
7.60	1,071	9.70	3,341	12.50	6,935	16.70	13,088
7.65	1,121	9.75	3,401	12.60	7.076	16.80	13,242
7.70	1,171	9.80	3,461	12.70	7,217	16.90	13,396
7.75	1,222	9.85	3,521	12.80	7,358	17.00	13,550
7.80	1,272	9.90	3,580	12.90	7,499	17.10	13,704
7.85	1,322	9.95	3,640	13.00	7,640	17.20	13,858
7.90	1,372	10.00	3,700	13.10	7,782	17.30	14,012
7.95	1,422	10.05	3,761	13.20	7,925	17.40	14,166
8.00	1,472	10.10	3,822	13.30	8,068	17.50	14,320
8.05	1,525	10.15	3,882	13.40	8,210		

Rating table for Rondout Creek at Rosendale, N. Y., for average ice conditions.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.60	18	7.60	442	8.60	1,117	9.60	1,930
6.65	35	7.65	473	8.65	1,156	9.65	1,975
6.70	51	7.70	503	8.70	1,194	9.70	2,020
6.75	68	7.75	534	8.75	1,233	9.75	2,065
6.80	84	7.80	564	8.80	1,271	9.80	2,110
6.85	101	7.85	595	8.85	1,310	9.85	2,155
6.90	117	7.90	626	8.90	1,348	9.90	2,200
6.95	134	7.95	657	8.95	1,387	9.95	2,245
7.00	150	8.00	688	9.00	1,425	10.00	2,290
7.05	173	8.05	723	9.05	1,467	10.05	2,337
7.10	196	8.10	758	9.10	1,508	10.10	2,384
7.15	219	8.15	794	9.15	1,550	10.15	2,431
7.20	242	8.20	829	9.20	1,591	10.20	2,477
7.25	265	8.25	865	9.25	1,633	10.25	2,524
7.30	288	8.30	900	9.30	1,674	10.30	2,571
7.35	311	8.35	935	9.35	1,716	10.35	2,618
7.40	334	8.40	970	9.40	1,757	10.40	2,664
7.45	357	8.45	1,005	9.45	1,799	10.45	2,711
7.50	380	8.50	1,040	9.50	1,840	10.50	2,758
7.55	411	8.55	1,079	9.55	1,885	10.55	2,807

Mean daily discharge, in second-feet, of Rondout Creek at Rosendale, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	359	1,021	678	182	185
2	.....	.....	.....	.....	.....	.....	.....	214	1,151	384	182	132
3	.....	.....	.....	.....	.....	.....	.....	142	1,202	446	182	168
4	.....	.....	.....	.....	.....	.....	.....	124	1,011	353	164	340
5	.....	.....	.....	.....	.....	.....	.....	96	842	290	146	353
6	.....	.....	.....	.....	.....	.....	.....	160	478	247	146	340
7	.....	.....	.....	.....	.....	.....	.....	3,365	415	210	146	384
8	.....	.....	.....	.....	.....	.....	224	807	353	210	146	434
9	.....	.....	.....	.....	.....	.....	188	465	290	203	146	566
10	.....	.....	.....	.....	.....	.....	135	278	246	175	146	2,573
11	.....	.....	.....	.....	.....	.....	118	661	246	168	136	2,629
12	.....	.....	.....	.....	.....	.....	135	868	278	168	164	1,525
13	.....	.....	.....	.....	.....	.....	153	434	322	192	428	1,051
14	.....	.....	.....	.....	.....	.....	164	234	228	669	334	2,323
15	.....	.....	.....	.....	.....	.....	153	214	203	1,101	225	12,903
16	.....	.....	.....	.....	.....	.....	182	220	269	781	217	4,223
17	.....	.....	.....	.....	.....	.....	153	214	290	540	199	2,302
18	.....	.....	.....	.....	.....	.....	440	359	528	478	199	1,715
19	.....	.....	.....	.....	.....	.....	253	764	403	415	199	1,071
20	.....	.....	.....	.....	.....	.....	218	484	278	353	182	868
21	.....	.....	.....	.....	.....	.....	214	2,226	221	309	146	868
22	.....	.....	.....	.....	.....	.....	178	1,588	210	290	128	885
23	.....	.....	.....	.....	.....	.....	188	936	192	290	146	1,251
24	.....	.....	.....	.....	.....	.....	171	2,496	175	228	182	1,051
25	.....	.....	.....	.....	.....	.....	171	2,944	168	228	945	583
26	.....	.....	.....	.....	.....	.....	153	1,535	149	228	643	508
27	.....	.....	.....	.....	.....	.....	214	911	139	228	440	434
28	.....	.....	.....	.....	.....	.....	196	634	132	259	378	695
29	.....	.....	.....	.....	.....	.....	178	484	528	192	334	2,464
30	.....	.....	.....	.....	.....	.....	328	868	833	192	334	6,182
31	.....	.....	.....	.....	.....	.....	359	340	.....	192	.....	3,496

Mean daily discharge, in second-feet, of Rondout Creek at Rosendale, N. Y., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2,054	2,302	13,520	1,472	1,578	217	540	1,171	160	3,870	807	409
2	1,202	2,270	8,970	1,141	1,021	182	434	1,842	143	2,922	704	390
3	1,202	a1,885	6,223	885	1,021	207	478	1,071	118	1,989	618	515
4	1,202	a1,550	3,138	885	1,071	241	1,101	781	125	1,432	592	764
5	1,202	a1,840	1,978	687	842	182	652	609	107	1,332	515	503
6	1,121	a1,467	1,302	600	687	153	592	756	135	2,367	503	453
7	885	a1,271	1,202	902	643	182	496	825	143	1,535	549	549
8	a 196	a1,132	911	1,392	540	171	421	566	143	1,181	484	575
9	a 134	a 956	2,741	6,346	459	182	403	496	153	919	453	503
10	a 120	a 595	3,080	5,206	397	143	297	434	592	747	440	678
11	a 127	a 676	2,629	3,186	365	118	234	415	315	549	409	a 214
12	a 233	a 595	3,080	2,507	365	135	214	478	214	3,472	409	a 178
13	a 77	a 552	4,712	1,789	334	135	203	415	234	2,226	409	a 155
14	a 18	a 485	3,616	1,442	241	143	185	353	378	1,535	390	a 247
15	a 35	a 442	2,464	1,141	217	135	150	259	253	1,111	390	a 414
16	a 61	a 357	2,086	945	259	135	168	278	196	893	390	1,905
17	a 18	a 297	7,471	816	210	188	143	228	160	790	359	7,654
18	a 15	a 334	3,377	712	217	171	132	210	143	704	359	3,773
19	a 18	a 219	1,926	660	210	118	143	192	135	661	378	2,388
20	a 15	a 251	1,504	502	210	164	937	192	160	618	359	1,852
21	a 18	a 251	1,322	490	200	164	2,248	185	265	549	359	1,905
22	a7,200	a 242	1,252	459	175	534	2,663	221	214	515	359	8,367
23	a1,984	a 251	1,131	428	168	284	1,799	192	153	453	328	4,479
24	a 815	a 274	1,051	365	157	189	4,896	192	160	453	328	3,234
25	a 491	311	885	353	139	153	3,918	168	234	453	297	2,065
26	a 380	709	738	409	322	164	2,410	157	3,057	409	390	1,641
27	a1,624	a2,730	678	397	365	189	1,641	150	3,472	347	421	2,464
28	1,051	a6,200	626	315	583	164	1,202	139	2,259	3,472	515	981
29	1,302	.....	3,425	284	353	171	807	168	10,811	2,173	503	825
30	1,472	.....	2,888	2,753	210	1,061	1,202	157	3,834	1,362	453	764
31	1,926	.....	1,905	.....	221	.....	764	157	.....	981	.....	764

Mean daily discharge, in second-feet, of Rondout Creek at Rosendale, N. Y., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	704	3,712	6,921	1,641	272	75	1,852	203	2,697	192	490	.....
2	721	3,413	3,080	1,181	241	68	1,091	160	1,810	174	478	.....
3	1,131	4,076	2,248	1,041	224	57	661	139	1,272	174	465	.....
4	2,226	3,724	1,821	1,292	241	75	515	234	971	174	478	.....
5	1,662	3,532	1,873	1,111	272	132	415	5,258	781	174	465	.....
6	1,131	2,065	1,694	893	241	50	328	3,057	609	174	583	.....
7	807	1,535	1,620	807	217	45	309	3,496	465	192	490	.....
8	1,031	1,181	2,442	1,382	217	45	210	2,086	446	192	.....	.....
9	721	981	4,626	2,674	200	221	175	1,578	415	18,130	.....	.....
10	790	764	3,532	1,884	182	146	178	1,121	415	17,740	.....	.....
11	893	807	4,871	1,392	182	168	157	540	403	4,530	.....	.....
12	1,332	3,712	3,604	1,151	168	5,466	157	712	340	2,930	.....	.....
13	1,747	2,550	2,640	954	164	3,377	150	484	303	2,160	.....	.....
14	2,280	2,173	2,119	911	146	1,652	139	390	290	1,580	.....	.....
15	2,388	1,483	1,747	2,065	153	3,210	132	322	259	1,320	.....	.....
16	2,442	1,282	1,483	1,821	164	2,507	128	322	228	1,120	.....	.....
17	[a] 836	[a] 1,163	1,242	1,302	146	1,462	157	384	353	1,170	.....	.....
18	[a] 540	[a] 2,209	1,111	981	128	1,242	157	297	1,472	1,170	.....	.....
19	[a] 293	[a] 2,092	954	807	128	928	465	353	540	1,770	.....	.....
20	[a] 293	[a] 1,993	876	695	114	1,242	353	652	415	1,050	.....	.....
21	[a] 730	[a] 1,849	868	549	111	5,665	1,171	540	353	884	.....	.....
22	[b] 1,724	[a] 1,682	2,753	515	111	4,088	384	353	290	781	.....	.....
23	[a] 836	[a] 1,086	4,786	515	93	2,933	1,332	259	259	730	.....	.....
24	[a] 509	[a] 1,012	6,060	465	75	4,638	583	228	210	800	.....	.....
25	[a] 632	[a] 695	3,312	421	82	2,956	265	446	200	670	.....	.....
26	[a] 695	[a] 479	2,173	390	93	2,022	214	1,001	192	643	.....	.....
27	[a] 632	[a] 362	1,673	359	93	1,362	178	490	192	557	.....	.....
28	[a] 509	[a] 3,410	1,332	328	82	902	143	509	192	540	.....	.....
29	[a] 1,012	.....	1,081	297	111	1,292	125	9,595	174	528	.....	.....
30	[a] 2,254	.....	945	265	93	2,550	309	5,895	192	508	.....	.....
31	4,320	.....	2,753	.....	75	.....	278	4,626	.....	528	.....	.....

[a] River frozen. [b] Beyond limit of curve.

Estimated monthly discharge of Rondout Creek at Rosendale, N. Y., for 1901–1903.

[Drainage area, 380 square miles.]

Month.	Discharge in second-feet.			Diversion to canal in second-feet.	Total yield of drainage area in second-feet.	Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.			Second-feet per square mile.	Depth in inches.	
1901.								
July 8–31	440	118	203	(a)	223	0.586	0.68	.....
August	3,365	96	820	(a)	840	2.209	2.55	.....
September	1,202	132	427	(a)	447	1.176	1.32	.....
October	1,101	168	345	20.0	365	.961	1.11	.....
November	945	128	252	19.0	271	.712	.79	.....
December	12,903	132	1,758	.....	1,758	4.624	5.33	.....
1902.								
January	7.200	15	910	.....	910	2.393	2.76	.....
February	6,200	219	1,087	.....	1,087	2.859	2.97	.....
March	13,520	626	2,962	b 18.0	2,967	7.803	8.97	.....
April	6,345	284	1,314	22.5	1,336	3.514	3.92	.....
May	1,578	139	445	24.0	469	1.233	1.42	.....
June	1,061	118	212	23.7	236	.621	.69	.....
July	4,896	132	1,015	23.8	1,039	2.732	3.15	.....
August	1,842	139	434	24.3	458	1.204	1.38	.....
September	10,811	107	949	24.0	973	2.558	2.86	.....
October	3,870	347	1,355	22.2	1,377	3.621	4.17	.....
November	807	297	449	18.2	467	1.228	1.36	.....
December	8,367	155	1,665	c 21.8	1,669	4.389	5.04	.....
The year	13,520	15	.....	.....	1,082	2.846	38.89	.....
1903.								
January	4,320	293	1,220	.....	1,220	3.209	3.70	.....
February	4,076	362	1,965	.....	1,965	5.168	5.37	.....
March	6,921	868	2,524	d 5.6	2,526	6.638	7.65	3.87
April	2,674	265	1,003	23.0	1,026	2.638	2.95	3.38
May	272	75	155	17.6	173	.408	.47	.74
June	5,665	45	1,686	16.4	1,702	4.434	4.95	12.75
July	1,852	125	410	17.4	427	1.078	1.25	.....
August	9,595	139	1,475	18.2	1,493	3.879	4.47	.....
September	2,697	174	554	18.8	572	1.504	1.67	.....
October	18,130	174	2,044	16.2	2,060	5.418	6.24	.....
November 1 to 7 inclusive	583	465	492	.....	492	1.294	1.44	.....

a No record. Assumed diversion 20 second-feet.
b March 23 to 31 inclusive.
c December 1 to 6 inclusive.
d March 20 to 31.

RONDOUT CREEK AT HONK FALLS, NEW YORK.

Rondout Creek above its junction with Sandberg Creek at Napanock (also called Lackawack Creek) is essentially a mountain stream. At Honk Falls a natural declivity affords a fall of 125 feet over tilted strata of Hudson River shale. This fall has been increased to 147.5 feet by the construction of a masonry dam at the head of the gorge.

Water to feed the turbines is carried to the power house, one-fourth mile below the dam, in a circular steel penstock. The turbines are a special design of the Victor type. The outflow from the turbines passes over a tailrace weir below the power house. The total flow of the stream passes either over the spillway of the dam or over the tailrace weir. The dam is of concrete masonry. It has an ogee-shaped cross section and a level spillway 186.6 feet in length.

Arrangements have been made for maintaining a record at this plant. A recording gage will be placed above the dam, arranged to keep a continuous record of the discharge over the dam. A record of the amount of water used by the turbines is kept by a similar gage placed above a weir in the tailrace. The maximum observed discharge of Rondout Creek at Honk Falls has been 8,650 second-feet, or 98.1 second-feet per square mile, from the tributary drainage area of 88 square miles.

The power is used for the generation of electricity, which is transmitted to Ellensville, a distance of 3 miles.

The record at this station was maintained during a portion of 1903, but the computation of the discharge is withheld.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

ESOPUS CREEK AT KINGSTON, N. Y.

This station was established by R. E. Horton and G. B. Hollister. It is located at the Washington Avenue Bridge, ½ mile from the Ulster and Delaware Railroad bridge, at Kingston, N. Y. The original wire gage was replaced July 14, 1903, by a standard chain gage, which was installed by F. H. Tillinghast. The length of the chain from the end of the weight to the marker is 31.04 feet. The gage is fastened to the lower chord on the upstream side of the bridge near the left end. It is read twice each day by John Douglas. Discharge measurements are made at ordinary stages from the downstream side of the bridge. At low stages they are made by wading above or below the bridge. At flood stages measurements are sometimes made at the Ulster and Delaware Railroad bridge, one-half mile above the station. The bridge at which the station is located has a single span of 117 feet between abutments. The initial point for soundings is the face of the right abutment. The channel is straight for 300 feet above and for 500 feet below the station. The right bank is subject to overflow only at flood stages. The overflow area is restricted at the gage by the highway. The left bank overflows during severe freshets for a distance of about 300 feet, but the amount of water passing over it can be easily estimated. The bed of the stream is composed of earth

and cobblestones and is not subject to change. The bench mark is a circular chisel draft on the corner of the right abutment on the upstream side. Its elevation is 31.73 feet above the gage datum. The top of the gage pulley is 30.87 feet above gage datum. The top of the bridge chord at the gage is 30.57 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Esopus Creek at Kingston, N. Y., in 1901–1903.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.	
1901.		*Feet.*	*Feet.*	*Second-feet.*
July 5	Horton and Hollister	4.32	4.31	148
July 18	A. E. Place	4.10	4.09	145
July 19	do	4.40	4.39	173
July 22	do	3.80	3.79	[a] 64
August 5	do	3.90	3.87	[b] 36
August 8	do	6.95	6.92	396
August 10	do	4.85	4.82	239
August 19	Hollister and Place	4.60	4.57	180
August 27	A. E. Place	6.27	6.24	729
August 29	do	5.50	5.47	364
September 4	do	6.115	6.075	554
September 6	do	5.46	5.42	352
September 21	W. W. Schlecht	4.78	4.74	200
September 26	do	4.55	4.51	[a] 168
Do	do	4.55	4.51	150
October 3	do	5.26	5.20	329
October 8	do	4.70	4.64	178
October 10	do	4.62	4.56	166
Do	G. B. Hollister	4.62	4.56	188
October 16	W. W. Schlecht	6.64	6.58	785
October 21	do	5.56	5.50	381
November 1	do	4.74	4.66	184
November 14	do	4.75	4.67	[c] 195
November 18	do	4.45	4.37	[d] 126
November 26	do	5.06	4.98	245
December 4	do	5.28	5.19	236
December 11	do	11.46	11.37	1,721
December 19	do	8.35	8.26	[e] 1,472
December 30	do	12.15	12.06	[f] 3,989

[a] Ulster and Delaware R. R. bridge.
[b] Wading 200 feet upstream.
[c] Downstream side of bridge.
[d] Upstream side of bridge.
[e] River full of thin ice.
[f] Ice jam below bridge.

Discharge measurements of Esopus Creek at Kingston, N. Y.—Continued.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.	
1902.		*Feet.*	*Feet.*	*Second-feet.*
January 9	W. W. Schlecht	6.54	6.43	[a] 522
January 22	do	16.20	16.09	[b] 6,747
Do	do	15.00	14.89	[c] 5,333
January 27	do	9.70	9.59	[d] 2,761
January 29	do	7.73	7.62	1,149
February 7	do	6.83	6.70	[e] 530
February 15	do	5.60	5.47	[f] 337
February 20	do	5.38	5.25	[f] 245
February 28	do	9.14	9.01	[g] 1,687
March 1	do	20.38	20.24	[h] 12,620
March 12	Horton and Schlecht	9.90	9.76	2,843
April 10	W. W. Schlecht	13.37	13.21	5,021
April 23	do	6.94	6.78	828
April 30	do	10.28	10.12	2,813
May 14	do	5.83	5.65	422
Do	do	7.14	6.96	[i] 508
May 24	do	6.38	6.20	[i] 274
Do	do	5.02	4.84	225
June 5	do	6.41	6.22	[i] 272
Do	do	5.03	4.84	234
June 16	do	4.48	4.29	136
June 26	do	4.98	4.79	231
July 9	H. K. Barrows & W. W. Schlecht.	5.81	5.66	450
July 16	H. K. Barrows	5.13	4.98	269
July 24	do	8.11	7.96	1,348
July 30	do	7.65	7.50	1,155
August 12	do	6.28	6.09	550
August 21	do	4.94	4.75	191
September 4	do	4.49	4.27	133
September 23	P. M. Churchill	5.87	5.65	449
October 4	do	9.32	9.07	1,890
November 5	F. H. Tillinghast	6.55	6.27	594
November 11	do	6.00	5.72	416
November 22	do	5.45	5.17	272
December 11	do	6.60	6.30	[j] 476
December 18	do	13.00	12.70	3,461
December 22	do	16.00	15.70	8,594

[a] Ice.
[b] Surface velocities used, ×.85, ice going out.
[c] Surface velocities used, ×.85, drifting ice.
[d] Meter damaged at station 110.
[e] Ice above and below bridge. Open section at bridge.
[f] Ice above and below bridge.
[g] River partly covered with ice.
[h] Surface velocities used, ×.85.
[i] At Glasgow Bridge Glen Erie.
[j] Ice 0.10 thick.

Discharge measurements of Esopus Creek at Kingston, N. Y.—Continued.

Date.	Hydrographer.	Gage height.		Discharge.
		Original reading.	Corrected reading.	
1903.		*Feet.*	*Feet.*	*Second-feet.*
January 14	F. H. Tillinghast	6.90	6.60	[a] 425
February 6	do	9.50	9.20	[b] 2,141
February 24	do	7.10	6.80	654
March 2	do	11.63	11.33	3,830
April 29	do	5.72	5.42	365
May 21	do	4.65	4.35	132
July 22	do	5.17	5.17	315
September 4		7.66	7.66	1,181

[a] Partly ice covered, 7 inches thick. [b] No ice.

Mean daily gage height, in feet, of Esopus Creek at Kingston, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1								3.95	6.44	4.47	4.55	4.51
2								3.92	6.26	4.57	4.45	4.44
3								3.87	6.64	4.64	4.27	4.69
4								4.92	6.24	4.47	4.30	5.36
5							4.29	3.92	5.76	4.37	4.47	4.54
6							4.34	3.67	5.54	4.24	4.40	4.59
7							4.29	3.92	5.39	4.42	4.50	4.64
8							4.39	6.97	4.99	4.52	4.40	4.56
9							4.39	5.70	5.14	4.44	4.25	.....
10							4.24	5.15	4.91	4.47	4.25	4.51
11							4.24	5.02	4.99	4.42	4.37	11.41
12							4.29	4.85	4.84	4.34	4.50	9.64
13							4.29	4.70	4.86	4.44	4.52	7.26
14							4.19	4.57	4.84	4.47	4.37	8.04
15							3.94	4.40	4.69	4.52	4.30	21.29
16							4.19	4.40	4.71	4.59	4.35	15.11
17							4.04	4.35	4.96	4.42	4.22	10.46
18							4.04	4.52	5.24	4.37	4.30	8.96
19							4.59	4.47	5.04	4.54	4.45	8.01
20							4.14	4.75	5.31	4.72	4.42	7.91
21							4.09	5.92	5.14	4.72	4.40	7.66
22							3.89	6.60	4.74	4.62	4.45	7.11
23							4.04	5.90	4.89	4.62	4.37	6.76
24							3.99	7.32	4.74	4.57	4.45	6.61
25							3.89	7.65	4.46	4.57	4.55	6.41
26							3.97	6.50	4.34	4.47	4.52	6.26
27							3.92	6.00	4.46	4.37	4.50	6.16
28							3.84	5.85	4.69	4.39	4.70	5.91
29							3.71	5.70	4.41	4.52	5.37	7.46
30							4.19	5.42	4.39	4.42	4.45	11.56
31							4.24	5.20	.....	4.54	.....	9.36

Mean daily height, in feet, of Esopus Creek, at Kingston, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	8.09	7.12	19.96	9.19	8.77	4.66	6.23	6.90	4.23	13.13	7.00	5.60
2	10.24	7.32	16.67	8.53	8.00	4.64	6.04	7.76	4.26	11.43	6.25	5.40
3	a 9.84	9.22	15.61	7.89	7.60	4.57	5.80	6.91	4.21	9.85	5.55	5.89
4	a 8.29	7.58	10.92	7.48	7.52	4.64	6.25	6.71	4.11	9.03	6.27	6.18
5	a 7.54	7.38	9.31	7.17	7.25	4.51	5.84	6.34	4.16	8.35	6.27	6.03
6	a 7.19	a 7.02	8.81	6.87	6.95	4.54	6.04	6.89	4.11	9.39	5.97	5.88
7	a 6.84	a 6.57	7.76	7.02	6.80	4.36	6.01	6.71	4.16	8.43	6.23	6.05
8	a 6.54	a 6.33	7.54	7.12	6.56	4.44	5.87	6.24	4.16	7.93	6.07	6.30
9	a 6.39	a 6.01	8.71	12.94	6.37	4.44	5.65	5.98	4.16	7.60	5.85	6.15
10	a 6.29	a 6.12	9.06	13.70	6.22	4.49	5.43	5.69	7.46	7.15	5.72	5.70
11	a 6.24	a 9.81	8.91	11.44	6.05	4.39	5.35	5.64	5.78	6.90	7.57	a 6.05
12	a 5.77	a 5.75	9.66	10.12	5.92	4.26	5.19	6.06	5.27	8.85	5.67	a 6.25
13	a 5.89	a 6.63	11.71	9.25	5.78	4.34	4.95	5.54	5.31	8.21	5.57	a 6.05
14	a 5.82	a 5.47	11.67	8.62	5.70	4.39	4.90	5.39	5.96	7.75	5.50	a 6.10
15	a 5.49	a 5.45	9.84	8.09	5.52	4.21	4.83	5.19	5.63	7.35	5.45	a 6.13
16	a 5.47	a 5.40	9.19	7.74	5.52	4.27	4.84	5.11	5.31	7.08	5.35	a 6.35
17	a 5.48	a 5.50	18.76	7.42	5.32	4.59	4.74	4.89	5.08	6.90	5.32	a 15.90
18	a 5.17	a 5.26	12.96	7.19	5.15	4.75	4.65	4.91	4.91	6.70	5.32	a 12.56
19	a 4.39	a 5.32	9.99	6.94	5.20	4.44	4.63	4.79	4.86	6.50	5.26	a 10.72
20	a 5.25	a 5.17	9.06	6.77	5.21	4.41	6.23	4.79	5.08	6.48	5.18	a 9.65
21	a 4.84	a 5.22	8.47	6.64	5.10	4.62	9.85	4.69	6.66	6.23	5.17	8.25
22	a 12.62	a 5.22	8.11	6.77	4.95	5.36	9.35	4.66	6.06	6.05	5.10	15.30
23	10.77	a 5.17	7.84	6.72	4.85	4.94	9.13	4.59	5.66	5.95	5.08	12.50
24	8.77	a 5.22	7.72	6.72	4.82	4.74	8.23	4.41	5.46	5.88	5.08	10.10
25	7.89	a 5.26	7.49	6.42	4.70	4.62	8.43	4.51	5.46	5.83	4.92	9.05
26	7.42	a 6.32	7.29	6.20	5.02	4.78	8.53	4.46	6.78	5.63	5.02	8.40
27	8.52	a 9.17	7.14	6.19	5.02	5.00	7.86	4.36	10.13	5.53	5.72	7.98
28	7.97	a 9.23	7.05	6.04	5.40	4.69	7.60	4.46	9.26	7.59	6.32	8.45
29	7.02	.....	11.51	5.82	5.07	4.66	7.04	4.51	22.21	8.10	5.82	a 8.80
30	7.71	.....	12.41	9.65	4.85	6.95	7.53	4.41	17.13	7.50	5.60	a 8.67
31	7.37	.....	10.31	.....	4.85	.....	7.20	4.44	.....	7.28	.....	a 7.75

a River frozen

Mean daily height, in feet, of Esopus Creek, at Kingston, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	a 7.10	a 9.00	16.55	8.67	5.45	3.82	7.48	4.65	10.91	4.80	5.90	5.84
2	a 6.98	a 8.40	11.25	8.25	5.20	4.05	6.95	4.50	9.35	4.74	5.88	5.74
3	a 8.03	a 8.93	9.55	8.05	5.17	4.00	6.48	4.42	8.32	4.68	5.74	5.81
4	a 9.05	10.10	8.77	8.02	5.37	3.95	6.18	4.77	7.60	4.60	5.80	5.54
5	a 7.70	10.35	8.40	7.70	5.20	3.93	6.00	8.05	7.15	4.50	5.68	5.56
6	a 7.35	9.10	8.20	7.37	5.12	3.87	5.56	7.52	6.72	4.68	5.98	5.51
7	a 7.00	8.36	7.92	7.25	5.07	3.90	5.62	7.58	6.35	4.62	5.75	5.56
8	a 7.03	7.85	8.10	7.48	5.05	3.90	5.34	6.80	6.18	5.58	5.62	5.46
9	a 7.53	7.50	11.07	8.75	4.90	4.55	5.25	6.28	5.96	22.71	5.68	5.36
10	a 6.93	7.20	11.40	8.77	4.85	4.35	5.10	6.26	5.85	20.52	5.60	5.81
11	a 6.70	7.00	11.27	8.27	4.85	4.42	5.00	5.82	5.72	13.82	5.55	5.51
12	a 7.00	9.92	11.22	7.87	4.77	13.25	4.80	6.01	5.62	12.75	5.50	4.91
13	a 6.73	9.05	9.95	7.52	4.60	12.02	4.82	5.74	5.32	9.65	5.50	6.08
14	a 6.68	8.58	9.20	7.35	4.60	8.98	b 4.78	5.45	5.35	9.20	5.56	10.54
15	a 6.75	8.01	9.00	7.74	4.70	10.35	4.65	5.32	5.18	8.60	5.32	9.61
16	a 6.70	7.75	8.48	7.90	4.57	9.92	4.66	5.20	5.12	8.32	5.44	8.84
17	a 6.55	a 9.53	8.05	7.57	4.45	8.88	4.62	5.54	5.25	7.90	7.42	8.61
18	a 6.30	a 9.05	7.75	7.20	4.50	8.28	4.50	5.28	7.30	8.38	8.82	8.41
19	a 5.80	a 9.02	7.57	6.95	4.42	7.80	4.96	5.14	6.04	7.62	8.15	7.67
20	a 5.48	a 7.80	7.60	6.77	4.35	7.40	5.55	7.65	5.68	7.30	7.58	7.91
21	a 6.25	a 7.52	7.75	6.60	4.35	12.38	5.55	7.10	5.61	7.15	7.58	16.16
22	a 8.30	a 7.33	11.25	6.40	4.20	11.44	5.08	6.28	5.30	6.92	6.98	12.41
23	a 7.73	a 6.82	12.70	6.30	4.20	10.35	5.76	6.02	5.22	6.85	6.88	10.86
24	a 6.75	a 6.82	16.80	6.15	4.20	12.72	5.48	5.90	5.12	6.95	6.90	10.26
25	a 6.60	a 6.45	12.27	5.95	3.97	11.05	5.15	5.55	4.98	6.95	6.62	9.81
26	a 6.55	a 6.25	10.02	5.87	4.15	9.51	4.80	6.08	4.98	6.62	6.30	9.38
27	a 6.55	a 6.18	10.02	5.85	4.07	8.41	4.72	5.70	4.88	6.50	6.34	8.06
28	a 6.75	11.30	8.35	5.62	4.05	7.61	4.68	5.64	4.92	6.38	6.18	8.36
29	a 7.50	.....	7.87	5.55	4.12	7.50	4.58	13.92	4.82	6.32	6.05	7.71
30	a 9.30	.....	7.50	5.45	4.05	8.27	4.60	14.66	4.78	6.20	6.00	7.61
31	a 9.83	.....	9.70	.....	4.02	.....	4.76	13.88	.....	6.14	.....	7.66

a River frozen. b New gage wire put in July 15. Correction was continued to July 31.

Rating table for Esopus Creek at Kingston, N. Y., from July 5, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.50	8	5.45	371	7.40	1,085	9.35	2,174
3.55	15	5.50	383	7.45	1,108	9.40	2,208
3.60	22	5.55	397	7.50	1,130	9.45	2,242
3.65	29	5.60	412	7.55	1,154	9.50	2,275
3.70	36	5.65	426	7.60	1,179	9.55	2,312
3.75	42	5.70	441	7.65	1,203	9.60	2,348
3.80	49	5.75	455	7.70	1,227	9.65	2,385
3.85	56	5.80	469	7.75	1,252	9.70	2,422
3.90	63	5.85	484	7.80	1,276	9.75	2,458
3.95	70	5.90	498	7.85	1,300	9.80	2,495
4.00	77	5.95	513	7.90	1,324	9.85	2,532
4.05	85	6.00	527	7.95	1,349	9.90	2,569
4.10	94	6.05	544	8.00	1,373	9.95	2,605
4.15	102	6.10	562	8.05	1,400	10.00	2,642
4.20	110	6.15	579	8.10	1,426	10.05	2,681
4.25	118	6.20	596	8.15	1,453	10.10	2,720
4.30	127	6.25	614	8.20	1,480	10.15	2,758
4.35	135	6.30	631	8.25	1,506	10.20	2,797
4.40	143	6.35	648	8.30	1,533	10.25	2,835
4.45	152	6.40	665	8.35	1,560	10.30	2,875
4.50	160	6.45	683	8.40	1,587	10.35	2,913
4.55	170	6.50	700	8.45	1,613	10.40	2,952
4.60	180	6.55	720	8.50	1,640	10.45	2,991
4.65	190	6.60	741	8.55	1,670	10.50	3,030
4.70	200	6.65	762	8.60	1,700	10.60	3,112
4.75	210	6.70	782	8.65	1,730	10.70	3,194
4.80	220	6.75	802	8.70	1,760	10.75	3,235
4.85	230	6.80	823	8.75	1,790	10.80	3,276
4.90	240	6.85	844	8.80	1,820	10.90	3,358
4.95	250	6.90	864	8.85	1,850	11.00	3,440
5.00	260	6.95	884	8.90	1,880	11.05	3,485
5.05	272	7.00	905	8.95	1,910	11.10	3,530
5.10	285	7.05	928	9.00	1,940	11.20	3,620
5.15	297	7.10	950	9.05	1,974	11.25	3,665
5.20	309	7.15	972	9.10	2,007	11.30	3,710
5.25	322	7.20	995	9.15	2,040	11.40	3,800
5.30	334	7.25	1,018	9.20	2,074	11.45	3,845
5.35	346	7.30	1,040	9.25	2,108	11.50	3,890
5.40	358	7.35	1,062	9.30	2,141	11.55	3,935

Rating table for Esopus Creek at Kingston, N. Y., etc.—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
11.60	3,980	15.20	7,522	18.75	12,050	22.40	18,160
11.65	4,025	15.30	7,628	18.80	12,120	22.50	18,350
11.70	4,070	15.40	7,734	18.90	12,260	22.60	18,540
11.80	4,160	15.50	7,840	19.00	12,400	22.70	18,730
11.90	4,250	15.60	7,950	19.10	12,560	22.80	18,920
12.00	4,340	15.70	8,060	19.20	12,720	22.90	19,110
12.10	4,434	15.80	8,170	19.30	12,880	23.00	19,300
12.20	4,528	15.90	8,280	19.40	13,040	23.10	19,500
12.30	4,622	16.00	8,390	19.50	13,200	23.20	19,700
12.40	4,716	16.10	8,528	19.60	13,340	23.30	19,900
12.50	4,810	16.20	8,666	19.70	13,480	23.40	20,100
12.60	4,909	16.30	8,864	19.80	13,620	23.50	20,300
12.70	5,008	16.40	8,942	19.90	13,760	23.60	20,500
12.80	5,107	16.50	9,080	19.95	13,830	23.70	20,700
12.90	5,206	16.55	9,142	20.00	13,900	23.80	20,900
12.95	5,255	16.60	9,204	20.10	14,070	23.90	21,100
13.00	5,305	16.65	9,266	20.20	14,240	24.00	21,300
13.10	5,402	16.70	9,328	20.30	14,410	24.10	21,510
13.20	5,499	16.80	9,452	20.40	14,580	24.20	21,720
13.25	5,548	16.90	9,576	20.50	14,750	24.30	21,930
13.30	5,596	17.00	9,700	20.60	14,920	24.40	22,140
13.40	5,693	17.10	9,820	20.70	15,090	24.50	22,350
13.50	5,790	17.15	9,880	20.80	15,260	24.60	22,560
13.60	5,888	17.20	9,940	20.90	15,430	24.70	22,770
13.70	5,986	17.30	10,060	21.00	15,600	24.80	22,980
13.80	6,084	17.40	10,180	21.10	15,780	24.90	23,190
13.90	6,182	17.50	10,300	21.20	15,960	25.00	23,400
14.00	6,280	17.60	10,420	21.30	16,140	25.10	23,620
14.10	6,382	17.70	10,540	21.40	16,320	25.20	23,840
14.20	6,484	17.80	10,660	21.50	16,500	25.30	24,060
14.30	6,586	17.90	10,780	21.60	16,680	25.40	24,280
14.40	6,688	18.00	10,900	21.70	16,860	25.50	24,500
14.50	6,790	18.10	11,060	21.80	17,040	25.60	24,720
14.60	6,894	18.20	11,220	21.90	17,220	25.70	24,940
14.70	6,998	18.30	11,380	22.00	17,400	25.80	25,160
14.80	7,102	18.40	11,540	22.10	17,590	25.90	25,380
14.90	7,206	18.50	11,700	22.20	17,780	26.00	25,600
[a]15.00	7,310	18.60	11,840	22.25	17,875		
15.10	7,416	18.70	11,980	22.30	17,970		

[a] Logarithmic extension above 15 feet.

Mean daily discharge, in second-feet, of Esopus Creek, at Kingston, N. Y., for 1901–3.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	70	678	155	170	162
2	.....	.....	.....	.....	.....	.....	.....	65	616	174	151	150
3	.....	.....	.....	.....	.....	.....	.....	59	757	188	121	198
4	.....	.....	.....	.....	.....	.....	.....	244	610	155	126	348
5	.....	.....	.....	.....	.....	.....	125	65	457	138	155	168
6	.....	.....	.....	.....	.....	.....	133	31	394	116	143	178
7	.....	.....	.....	.....	.....	.....	125	65	355	146	160	188
8	.....	.....	.....	.....	.....	.....	141	892	258	164	143	172
9	.....	.....	.....	.....	.....	.....	141	440	294	150	118	.....
10	.....	.....	.....	.....	.....	.....	116	296	242	155	118	300
11	.....	.....	.....	.....	.....	.....	116	264	258	146	138	3,809
12	.....	.....	.....	.....	.....	.....	125	230	228	133	160	2,377
13	.....	.....	.....	.....	.....	.....	125	200	232	150	164	1,022
14	.....	.....	.....	.....	.....	.....	108	174	228	155	138	1,394
15	.....	.....	.....	.....	.....	.....	68	143	198	164	126	16,122
16	.....	.....	.....	.....	.....	.....	108	143	202	178	135	7,426
17	.....	.....	.....	.....	.....	.....	83	135	252	146	113	2,999
18	.....	.....	.....	.....	.....	.....	83	164	319	138	126	1,916
19	.....	.....	.....	.....	.....	.....	178	155	269	168	151	1,378
20	.....	.....	.....	.....	.....	.....	100	210	336	204	146	1,329
21	.....	.....	.....	.....	.....	.....	91	503	294	204	143	1,207
22	.....	.....	.....	.....	.....	.....	61	741	208	184	151	954
23	.....	.....	.....	.....	.....	.....	83	498	238	184	138	806
24	.....	.....	.....	.....	.....	.....	75	1,049	208	174	151	745
25	.....	.....	.....	.....	.....	.....	61	1,202	153	174	170	668
26	.....	.....	.....	.....	.....	.....	72	700	133	155	164	616
27	.....	.....	.....	.....	.....	.....	65	527	153	138	160	582
28	.....	.....	.....	.....	.....	.....	54	483	198	141	200	501
29	.....	.....	.....	.....	.....	.....	36	440	145	164	351	1,112
30	.....	.....	.....	.....	.....	.....	108	363	141	146	151	3,944
31	.....	.....	.....	.....	.....	.....	116	309	.....	168	.....	2,181

Mean daily discharge, in second-feet, of Esopus Creek, at Kingston, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1,421	959	13,844	2,067	1,802	192	607	864	115	5,431	905	412
2	2,827	1,049	9,290	1,658	1,373	188	541	1,256	120	3,827	614	358
3	[a]2,210	2,087	7,961	1,320	1,179	174	469	868	112	2,532	397	495
4	[a]1,287	1,169	3,374	1,121	1,140	188	614	786	95	1,960	620	572
5	[a]970	1,076	2,148	982	1,018	162	481	645	104	1,560	620	537
6	[a]780	[a]715	1,826	852	885	168	541	860	95	2,201	518	492
7	[a]650	[a]563	1,256	914	823	137	530	786	104	1,603	607	544
8	[a]585	[a]495	1,149	959	725	150	490	610	104	1,339	551	631
9	[a]510	[a]411	1,766	5,245	655	150	426	521	104	1,179	484	579
10	[a]485	[a]438	1,980	5,986	603	158	366	438	1,112	973	446	441
11	[a]470	[a]2,185	1,886	3,836	544	142	346	423	463	864	1,164	[a]422
12	[a]355	[a]352	2,392	2,735	504	120	307	548	326	1,850	432	[a]472
13	[a]383	[a]582	4,088	2,108	458	133	250	395	336	1,485	403	[a]422
14	[a]367	[a]292	4,043	1,712	441	142	240	356	515	1,252	383	[a]433
15	[a]295	[a]287	2,525	1,421	389	112	226	307	420	1,063	371	[a]443
16	[a]291	[a]277	2,067	1,247	389	122	228	287	336	941	346	[a]500
17	[a]293	[a]297	12,064	1,094	339	178	208	238	280	864	339	[a]5,700
18	[a]228	[a]248	5,265	991	297	210	190	242	242	782	339	[a]3,950
19	[a]93	[a]260	2,635	880	309	150	186	218	232	700	324	[a]2,840
20	[a]245	[a]232	1,980	811	312	145	607	218	280	694	304	[a]2,082
21	[a]168	[a]240	1,624	757	285	184	2,532	198	766	607	302	1,507
22	[a]4,000	[a]240	1,432	811	250	349	2,175	192	548	544	285	7,628
23	3,252	[a]232	1,295	790	230	248	2,027	178	429	513	280	4,810
24	1,802	[a]240	1,237	790	224	208	1,496	145	373	492	280	2,720
25	1,320	[a]248	1,126	672	200	184	1,603	162	373	478	244	1,974
26	1,094	[a]490	1,036	596	265	216	1,658	153	815	420	265	1,587
27	1,652	[a]1,783	968	593	265	260	1,305	137	2,743	391	446	1,368
28	1,358	[a]1,820	928	541	358	198	1,179	153	2,114	1,174	638	1,613
29	914	.....	3,899	475	277	192	923	162	17,800	1,426	475	[a]1,565
30	1,232	.....	4,725	2,385	230	885	1,145	145	9,856	1,130	412	[a]1,490
31	1,072	.....	2,890	.....	230	.....	995	150	.....	1,031	.....	[a]1,012

[a] River frozen.

Mean daily discharge, in second-feet, of Esopus Creek at Kingston, N. Y., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	a745	a1,680	9,142	1,742	371	52	1,121	190	3,368	220	498	481
2	a700	a1,350	3,665	1,507	309	85	884	160	2,174	208	492	452
3	a1,392	a1,640	2,312	1,400	302	77	693	146	1,544	196	452	472
4	a1,712	a2,720	1,802	1,384	351	70	589	214	1,178	180	469	394
5	a1,000	a2,913	1,587	1,227	309	67	527	1,400	972	160	434	400
6	a845	a2,007	1,480	1,072	290	59	400	1,140	790	196	521	386
7	a705	a1,565	1,334	1,018	277	63	418	1,168	648	184	455	400
8	a720	a1,300	1,426	1,121	272	63	344	823	589	406	418	373
9	a922	a1,130	3,503	1,790	240	170	322	624	515	18,730	434	348
10	a682	a995	3,800	1,802	230	135	284	617	484	14,750	412	472
11	a605	a905	3,683	1,517	230	146	260	475	446	6,080	397	386
12	a705	2,591	3,638	1,310	214	5,548	220	530	418	5,060	383	242
13	a615	1,974	2,605	1,140	180	4,358	224	452	338	2,390	383	554
14	a596	1,688	2,074	1,063	180	1,928	216	371	346	2,070	397	3,030
15	a618	1,378	1,940	1,247	200	2,913	190	338	304	1,700	338	2,360
16	a605	1,252	1,629	1,324	174	2,583	192	309	290	1,540	368	1,840
17	a557	a2,005	1,400	1,164	152	1,868	184	394	321	1,320	1,090	1,710
18	a487	a1,713	1,252	995	160	1,522	160	328	1,040	1,580	1,830	1,590
19	a362	a1,690	1,164	885	146	1,276	252	294	541	1,180	1,450	1,210
20	a274	a1,045	1,179	811	135	1,085	397	1,202	434	1,040	1,170	1,330
21	a473	a940	1,252	741	135	4,697	397	950	414	972	1,220	8,660
22	a1,292	a837	3,665	665	110	3,836	280	624	334	872	896	4,720
23	a1,012	a645	5,008	631	110	2,913	458	534	314	844	856	3,350
24	a618	a645	9,452	579	110	5,028	378	498	290	884	864	2,870
25	a572	a530	4,688	513	73	3,485	297	397	256	884	742	2,500
26	a557	a472	2,658	490	102	2,282	220	554	256	742	630	2,190
27	a557	a454	2,658	484	89	1,592	204	440	236	700	644	1,410
28	a618	3,710	1,560	418	85	1,183	196	423	244	558	589	1,670
29	a910	.....	1,310	397	97	1,130	176	6,200	224	638	544	1,230
30	a1,863	.....	1,130	371	85	1,517	180	6,950	216	596	527	1,180
31	a2,200	.....	2,422	.....	80	.....	212	6,163	.....	575	.....	1,210

a River frozen.

Estimated monthly discharge of Esopus Creek at Kingston, N. Y., for 1901–1903.

[Drainage area, 324.5 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1901.					
July	178	36	100	0.308	0.36
August	1,202	31	350	1.078	1.25
September	757	133	302	.93	1.04
October	204	116	160	.493	.56
November	351	113	153	.471	.52
December	16,122	150	1,832	5.64	6.50

Estimated monthly discharge of Esopus Creek at Kingston, N. Y., etc.—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
January	4,000	93	1,052	3.24	3.74
February	2,185	232	688	2.119	2.20
March	13,844	928	3,377	10.401	11.99
April	5,986	475	1,545	4.759	5.31
May	1,802	200	548	1.688	1.95
June	885	112	201	.619	.69
July	2,532	186	803	2.473	2.85
August	1,256	137	408	1.256	1.45
September	17,800	95	1,377	4.241	4.73
October	5,431	391	1,332	4.102	4.73
November	1,164	244	460	1.416	1.58
December	7,628	358	1,600	4.928	5.68
The year	17,800	93	1,116	3.194	46.90
1903.					
January	2,200	274	823	2.534	2.92
February	3,710	454	1,492	4.595	4.78
March	9,452	1,130	2,788	8.587	9.90
April	1,802	371	1,027	3.163	3.53
May	371	73	187	.575	.67
June	5,548	52	1,724	5.309	5.92
July	1,121	160	351	1.081	1.25
August	6,950	146	1,126	3.468	4.00
September	3,368	216	651	2.02	2.25
October	18,730	184	2,176	6.745	7.77
November	1,830	338	663	2.060	2.30
December	8,660	242	1,594	4.941	5.69
The year	18,730	52	1,134	3.756	50.98

ESOPUS CREEK AT OLIVE BRIDGE, N. Y.

This station was established May 25, 1903, by F. H. Tillinghast and W. H. Sears. It is located about 300 feet above the falls at Bishop's bridge, at a site selected by the engineers of the New York Water Supply Commission. The original wire gage was replaced July 15, 1903, by a standard chain gage, installed by F. H. Tillinghast. The gage datum was not changed. The gage is supported by a cantilever truss extend-

ing out from the right abutment of the old bridge for about 20 feet. The length of the chain from the end of the weight to the marker is 36.74 feet. The gage is read twice each day by J. B. Boice. Discharge measurements are made by means of a seven-eighths-inch cable and car. The cable is supported on both sides of the river by trees. At low water measurements are made by wading 500 feet below the falls. The initial point for soundings is the tree to which the cable is fastened on the right bank. The channel is straight for 300 feet above and below the station and has a width of 168 feet between the bridge abutments. Both banks are high, rocky, and wooded and are not subject to overflow. The bed of the stream is composed of solid rock. Bench mark No. 1 is a chisel draft on the upstream corner of the right abutment of the abandoned bridge. Its elevation is 18.14 feet above gage datum. Bench mark No. 2 is a spike in the chestnut tree to which the cable is fastened. Its elevation is 21.06 feet above gage datum. Bench mark No. 3 is a point marked on the truss which supports the gage, 6.7 feet from the pulley. Its elevation is 21.04 feet above gage datum. Bench mark No. 4 is the top of a bolt driven in the rock bottom under bench mark No. 3. Its elevation is 1.92 feet above gage datum. The top of the pulley wheel of the gage is 21.17 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Esopus Creek at Olive Bridge, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 2	F. H. Tillinghast	1.10	75
Do	do	1.05	60
June 11	do	1.13	90
June 13	do	3.08	1,828
June 17	do	2.67	1,290
July 2	do	2.14	635
July 4	do	1.92	428
July 9	do	1.60	229
July 15	do	1.30	145
August 11	do	1.70	340
August 14	do	1.62	270
August 29	do	5.55	7,601
September 2	do	2.74	1,345
September 8	do	1.81	396
October 10	do	5.70	7,682
Do	do	5.05	5,558
October 11	do	4.05	3,350
Do	do	3.78	2,861

Mean daily gage height, in feet, of Esopus Creek at Olive Bridge, N. Y., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.02	2.30	1.26	3.19	1.24	1.68	1.71
2	.....	1.05	2.10	1.21	2.78	1.22	1.67	1.70
3	.....	1.04	1.94	1.19	2.46	1.22	1.66	1.64
4	.....	.96	1.90	1.35	2.28	1.16	1.64	1.71
5	.....	.97	1.84	2.60	2.10	1.22	1.80	1.80
6	.....	.97	1.74	2.15	1.98	1.23	1.71	1.71
7	.....	.99	1.68	2.18	1.88	1.19	1.56	1.52
8	.....	1.24	1.61	1.93	1.78	2.38	1.62	1.51
9	.....	1.34	1.58	1.82	1.72	10.89	1.62	1.50
10	.....	1.11	1.54	1.78	1.66	5.70	1.62	1.55
11	.....	1.26	1.48	1.68	1.58	3.96	1.60	1.62
12	.....	4.35	1.43	1.80	1.55	3.28	1.59	1.68
13	.....	3.40	1.44	1.64	1.54	2.82	1.56	2.79
14	.....	2.98	1.34	1.58	1.50	2.55	1.54	2.08
15	.....	3.40	1.31	1.52	1.45	2.42	1.54	1.88
16	.....	3.10	1.28	1.57	1.41	2.22	1.58	1.88
17	.....	2.72	1.18	1.56	1.95	2.14	2.28	1.84
18	.....	2.50	1.12	1.50	2.02	2.34	2.55	1.78
19	.....	2.30	1.50	1.44	1.71	2.18	2.34	1.68
20	.....	2.34	1.36	2.55	1.60	2.15	2.16	2.99
21	.....	3.96	1.58	2.12	1.54	2.08	2.06	3.66
22	.....	3.38	1.42	1.90	1.50	2.02	2.04	2.85
23	.....	3.35	1.78	1.84	1.48	2.02	2.01	2.47
24	.....	4.10	1.52	1.79	1.42	1.99	1.97	2.31
25	1.15	3.40	1.40	1.76	1.39	1.98	1.89	2.30
26	1.10	2.85	1.34	1.80	1.36	1.81	1.77	2.31
27	1.02	2.55	1.29	1.68	1.36	1.78	1.74	1.94
28	1.07	2.28	1.27	1.82	1.38	1.76	1.76	1.92
29	1.05	2.56	1.21	5.72	1.32	1.75	1.66	1.82
30	1.05	2.42	1.32	4.38	1.28	1.74	1.72	1.89
31	1.05	.....	1.33	4.22	.....	1.69	.....	1.83

CATSKILL CREEK AT SOUTH CAIRO, N. Y.

This station was established July 4, 1901, by R. E. Horton and G. B. Hollister. It is located at the highway bridge, 1 mile from the Catskill Mountain Railroad. The original wire gage was replaced by a standard chain gage which was installed July 17, 1903, by F. H. Tillinghast. It is supported on the lower chord near the right end of the bridge on the downstream side. The length of the chain from the end of the weight to the marker is 23.13 feet. The gage is read twice each day by C. J. Abrams. Discharge measurements are made at ordinary stages from the downstream side of the bridge to which the gage is attached. The bridge has a single span of 194 feet between abutments. At low water measurements are made above the bridge by wading. The initial point for soundings is the face of the right abutment on the downstream side. The channel is straight for 500 feet above and below the station. The current has a moderate velocity and at low water is broken by rifts above and below the station. Both

banks are high and are not subject to overflow. The bed of the stream is composed of rock partly overlain with earth. The bench mark is a circular chisel draft on the corner capstone which forms the bridge seat on the upstream side of the right abutment. Its elevation is 21.29 feet above gage datum. The top of the gage pulley has an elevation of 22.96 feet above gage datum. At low water a gravel bar covered with willows is exposed near the middle of the channel. This causes slack water near the left bank.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Catskill Creek at South Cairo, N. Y., in 1901–1903.

Date.	Hydrographer.	Gage height.	Corrected discharge.
1901.		*Feet.*	*Second-feet.*
July 4	Horton and Hollister	2.75	63
July 17	Pressey and Place	[a] 3.85	268
July 20	A. E. Place	3.60	317
July 25	do	3.00	84
August 1	do	2.8	49
August 9	do	3.0	84
August 19	Hollister and Place	[b] 2.70	41
August 27	A. E. Place	3.12	120
September 2	do	3.0	90
September 7	do	2.92	71
September 23	W. W. Schlecht	2.73	37
October 4	do	2.70	26
October 10	Hollister and Schlecht	[b] 2.58	24
October 22	W. W. Schlecht	2.82	56
November 8	do	2.70	28
November 19	do	2.75	44
December 9	do	3.30	113

[a] Observer's gage height. [b] Wading 200 feet above bridge.

Discharge measurements of Catskill Creek at South Cairo, N. Y., in 1901–1903—Continued.

Date.	Hydrographer.	Gage height.	Corrected discharge.
1902.		*Feet.*	*Second-Feet.*
January 15	W. W. Schlecht	[a] 3.50	152
February 27	do	[b] 4.72	363
March 13	Horton and Schlecht	8.66	5,647
April 11	W. W. Schlecht	6.86	2,381
April 22	do	4.06	330
May 10	do	3.47	137
May 23	do	2.83	53
June 3	do	2.82	51
June 13	do	2.69	42
June 24	do	2.70	45
July 9	H. K. Barrows	3.365	117
July 23	do	6.11	1,650
August 2	do	5.36	1,035
August 13	do	3.49	139
August 27	do	2.74	41
September 5	do	2.79	51
September 22	P. M. Churchill	3.32	125
October 10	do	3.96	249
November 7	F. H. Tillinghast	3.80	242
November 17	do	3.40	143
December 3	do	3.90	284
December 18	do	5.45	1,086
1903.			
January 12	F. H. Tillinghast	3.62	168
February 20	do	3.69	[c] 213
March 3	do	4.75	662
March 12	do	5.98	1,495
March 28	do	4.70	664
April 24	do	3.90	285
May 22	do	2.50	36
June 3	do	2.30	17
July 17	do	2.60	46
August 12	do	2.99	92
August 27	do	3.12	120
September 9	do	3.31	151

[a] Ice along banks.
[b] Ice from 0.1 to 1 foot thick.
[c] Vertical velocities determined. Ice from bank to bank from 0.5 to 1.5 feet thick.

Mean daily gage height, in feet, of Catskill Creek at South Cairo, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	2.55	2.92	2.80	2.70	2.65
2	.....	.....	.....	.....	.....	.....	.....	2.60	3.00	2.75	2.70	2.65
3	.....	.....	.....	.....	.....	.....	.....	2.55	3.22	2.70	2.65	2.65
4	.....	.....	.....	.....	.....	.....	2.75	2.40	3.28	2.70	2.68	3.30
5	.....	.....	.....	.....	.....	.....	2.90	2.40	3.05	2.68	2.68	3.30
6	.....	.....	.....	.....	.....	.....	3.30	2.50	2.92	2.68	2.65	3.32
7	.....	.....	.....	.....	.....	.....	3.60	3.35	2.88	2.62	2.70	3.33
8	.....	.....	.....	.....	.....	.....	3.62	3.05	2.90	2.65	2.70	3.30
9	.....	.....	.....	.....	.....	.....	3.35	2.88	2.88	2.60	2.65	3.35
10	.....	.....	.....	.....	.....	.....	3.08	2.83	2.82	2.65	2.65	5.35
11	.....	.....	.....	.....	.....	.....	3.52	2.78	2.80	2.60	2.65	4.62
12	.....	.....	.....	.....	.....	.....	3.45	2.65	2.75	2.60	2.68	4.45
13	.....	.....	.....	.....	.....	.....	3.22	2.55	2.78	2.65	2.80	3.95
14	.....	.....	.....	.....	.....	.....	3.00	2.50	2.72	2.80	3.02	6.95
15	.....	.....	.....	.....	.....	.....	2.85	2.50	2.70	3.10	2.85	12.80
16	.....	.....	.....	.....	.....	.....	2.90	2.50	2.75	3.15	2.82	5.60
17	.....	.....	.....	.....	.....	.....	3.85	2.40	2.82	3.02	2.78	5.00
18	.....	.....	.....	.....	.....	.....	3.78	2.52	2.98	2.98	2.75	4.40
19	.....	.....	.....	.....	.....	.....	4.35	2.62	2.98	2.90	2.75	4.00
20	.....	.....	.....	.....	.....	.....	3.58	2.68	2.82	2.85	2.75	3.85
21	.....	.....	.....	.....	.....	.....	3.18	2.75	2.80	2.82	2.75	3.90
22	.....	.....	.....	.....	.....	.....	2.68	3.05	2.80	2.80	2.75	4.00
23	.....	.....	.....	.....	.....	.....	2.95	3.22	2.78	2.80	2.70	4.00
24	.....	.....	.....	.....	.....	.....	3.00	3.45	2.72	2.80	2.70	4.08
25	.....	.....	.....	.....	.....	.....	2.98	3.55	2.68	2.80	2.70	3.45
26	.....	.....	.....	.....	.....	.....	2.82	3.20	2.65	2.80	2.70	3.40
27	.....	.....	.....	.....	.....	.....	2.70	2.95	2.65	2.75	2.65	3.40
28	.....	.....	.....	.....	.....	.....	2.70	2.80	2.70	2.75	2.65	3.50
29	.....	.....	.....	.....	.....	.....	2.72	2.70	2.80	2.75	2.65	3.85
30	.....	.....	.....	.....	.....	.....	2.65	2.65	2.82	2.70	2.65	4.50
31	.....	.....	.....	.....	.....	.....	2.60	2.60	.....	2.70	.....	4.40

Mean daily gage height, in feet, of Catskill Creek at South Cairo, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	4.25	4.30	11.70	5.35	4.10	2.95	3.48	4.50	2.90	6.18	4.30	3.60
2	4.10	[a] 5.05	9.68	5.88	3.95	2.88	3.28	5.58	2.83	5.63	4.15	3.63
3	4.22	5.20	6.70	4.95	3.92	2.80	3.13	4.38	2.75	5.20	4.05	3.80
4	4.40	4.45	6.80	4.76	3.88	2.82	3.10	4.12	2.73	4.80	3.95	4.18
5	4.40	4.40	6.60	5.15	3.82	2.88	3.08	3.85	2.73	4.60	3.90	4.00
6	4.20	4.40	5.40	4.65	3.78	2.88	4.45	4.45	2.70	4.53	3.83	4.00
7	4.05	4.25	4.10	4.40	3.72	2.85	4.20	4.20	2.73	4.40	3.78	3.92
8	4.80	4.25	4.10	4.60	3.70	2.90	3.92	3.92	2.78	4.23	3.73	3.80
9	3.70	4.20	4.30	11.65	3.60	2.80	3.80	3.80	2.90	4.05	3.65	3.70
10	3.55	4.25	5.20	8.25	3.50	2.75	3.65	3.65	3.68	3.90	3.55	4.05
11	3.40	4.40	5.75	6.98	3.40	2.70	3.60	3.55	3.55	3.93	3.50	4.40
12	3.30	4.50	9.10	6.48	3.30	2.65	3.55	3.55	3.28	5.08	3.55	4.13
13	3.30	4.70	8.90	5.50	3.28	2.78	2.95	3.45	3.40	4.60	3.63	4.00
14	3.30	4.45	7.50	4.95	3.23	2.75	2.82	3.15	3.53	4.25	3.52	4.00
15	3.20	3.10	5.45	4.78	3.20	2.70	2.80	3.20	3.35	4.15	3.50	3.95
16	3.30	3.20	7.40	4.58	3.05	2.75	2.75	3.15	3.18	4.03	3.40	4.53
17	3.20	3.40	9.40	4.35	3.00	2.90	2.70	3.05	3.05	3.93	3.40	6.35
18	3.00	3.45	6.85	4.25	3.95	2.88	2.65	2.92	2.95	3.83	3.32	5.43
19	2.90	3.60	4.15	4.20	2.90	2.78	2.70	3.15	2.98	3.80	3.30	5.00
20	2.90	3.80	4.50	4.20	2.95	2.85	4.40	3.10	3.25	3.83	3.28	4.80
21	3.10	3.80	4.00	4.12	2.95	2.80	7.25	3.02	3.48	3.73	3.30	6.55
22	9.85	3.80	4.55	4.10	2.82	2.80	6.50	2.98	3.32	3.68	3.20	8.42
23	5.90	3.50	5.58	4.02	2.78	2.80	6.52	2.92	3.18	3.60	3.20	6.70
24	4.80	3.20	5.48	3.95	2.90	2.78	6.18	2.82	3.10	3.63	3.15	5.13
25	4.40	3.40	5.05	3.90	2.95	2.70	7.08	2.75	3.25	3.60	3.20	4.85
26	4.02	3.50	4.92	3.80	2.85	2.68	7.35	2.70	3.58	3.50	3.30	6.55
27	3.85	4.82	4.82	3.82	3.10	2.65	4.05	2.70	4.35	3.55	3.85	4.35
28	3.58	9.15	5.18	3.72	3.32	2.60	4.20	2.72	4.70	5.93	4.13	4.20
29	3.70	.....	5.72	3.95	3.25	2.80	4.40	2.85	6.45	5.30	3.80	4.13
30	4.25	.....	5.92	4.10	3.12	3.88	4.38	2.98	7.20	4.70	3.63	3.95
31	4.30	.....	5.40	.....	3.00	.....	4.25	3.08	.....	4.45	.....	3.85

[a] Ice February 2 to 28, inclusive.

Mean daily gage height, in feet, of Catskill Creek at South Cairo, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	3.75	4.50	7.07	5.75	3.17	2.25	4.15	2.68	5.80	2.55	3.68	3.30
2	3.83	4.30	5.30	5.05	3.10	2.25	3.85	2.65	4.95	2.55	3.58	3.30
3	4.35	4.32	4.75	4.80	3.07	2.25	3.58	2.58	4.55	2.55	3.56	3.28
4	5.10	5.40	4.70	4.75	3.00	2.25	3.42	2.58	4.22	2.50	3.50	3.20
5	4.65	5.15	4.60	4.50	3.00	2.25	3.12	3.65	4.02	2.50	3.72	3.20
6	4.32	4.43	4.55	4.45	2.95	2.25	3.27	3.82	3.82	2.55	3.88	3.20
7	4.08	4.25	4.75	4.37	2.90	2.25	3.05	3.62	3.60	2.55	3.75	3.20
8	4.00	4.00	5.50	4.60	2.85	2.42	3.06	3.42	3.48	3.12	3.58	3.20
9	3.60	3.90	6.95	5.30	2.80	2.35	2.97	3.18	3.38	17.54	3.52	3.20
10	3.50	3.85	6.25	4.70	2.77	2.30	2.91	3.10	3.22	10.80	3.50	3.20
11	3.50	3.97	7.50	4.45	2.70	2.32	2.68	3.00	3.18	7.45	3.45	3.10
12	3.60	5.70	6.15	4.25	2.70	5.90	2.66	2.98	3.10	6.48	3.40	3.10
13	3.45	4.73	6.56	4.20	2.70	5.55	2.63	2.92	3.00	5.75	3.40	4.05
14	3.45	4.32	5.20	4.30	2.70	4.45	2.58	2.78	2.92	5.30	3.40	4.50
15	3.50	4.15	4.92	5.85	2.70	5.55	2.56	2.72	2.90	4.98	3.38	4.20
16	3.43	4.03	4.75	6.15	2.65	5.30	2.51	2.70	2.80	4.78	3.30	3.80
17	3.50	3.70	4.52	5.17	2.60	4.50	2.87	2.65	3.02	4.70	4.88	3.80
18	3.33	3.52	4.42	4.65	2.60	4.35	2.55	2.60	3.35	4.88	4.65	3.70
19	3.08	3.73	4.30	4.45	2.60	4.05	2.70	2.60	3.18	4.62	4.32	3.50
20	3.23	3.60	4.30	4.25	2.55	4.15	2.72	3.30	2.98	4.52	4.22	6.26
21	4.20	3.73	4.20	4.12	2.50	7.10	2.75	2.95	2.82	4.42	3.98	6.02
22	4.70	3.65	6.65	4.02	2.50	6.30	2.70	2.82	2.80	4.30	3.88	4.60
23	4.45	3.37	9.05	3.95	2.45	5.87	2.70	2.75	2.75	4.28	3.80	4.58
24	4.45	3.50	7.57	3.95	2.40	7.40	2.70	2.65	2.70	4.28	3.95	4.35
25	4.13	3.37	5.90	3.80	2.40	5.90	2.60	2.72	2.65	4.18	3.72	4.40
26	3.60	3.32	5.25	3.70	2.40	5.15	2.55	3.35	2.60	4.12	3.52	4.30
27	3.58	3.25	4.60	3.55	2.40	4.60	2.50	3.20	2.60	3.98	3.48	4.55
28	3.63	7.80	4.60	3.42	2.52	4.25	2.45	3.10	2.55	3.90	3.38	4.58
29	4.15	.....	4.55	3.37	2.30	4.30	2.48	5.80	2.55	3.85	3.30	4.50
30	6.10	.....	4.42	3.25	2.30	4.40	2.68	7.60	2.55	3.80	3.30	4.50
31	4.85	.....	7.15	.....	2.25	.....	2.80	7.50	.....	3.80	.....	4.50

Rating table for Catskill Creek at South Cairo, N. Y., for open section from July 4, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	16	4.10	352	6.00	1,520	7.90	3,934
2.25	18	4.15	377	6.05	1,567	7.95	4,022
2.30	20	4.20	401	6.10	1,615	8.00	4,110
2.35	22	4.25	425	6.15	1,662	8.05	4,223
2.40	24	4.30	449	6.20	1,710	8.10	4,336
2.45	26	4.35	473	6.25	1,757	8.15	4,449
2.50	28	4.40	498	6.30	1,805	8.20	4,562
2.55	32	4.45	522	6.35	1,852	8.25	4,675
2.60	37	4.50	546	6.40	1,900	8.30	4,788
2.65	41	4.55	574	6.45	1,947	8.35	4,901
2.70	45	4.60	602	6.50	1,995	8.40	5,014
2.75	50	4.65	629	6.55	2,050	8.45	5,127
2.80	55	4.70	657	6.60	2,106	8.50	5,240
2.85	59	4.75	685	6.65	2,161	8.55	5,369
2.90	63	4.80	712	6.70	2,217	8.60	5,498
2.95	68	4.85	741	6.75	2,272	8.65	5,627
3.00	72	4.90	768	6.80	2,328	8.70	5,756
3.05	80	4.95	796	6.85	2,383	8.75	5,885
3.10	88	5.00	824	6.90	2,439	8.80	6,014
3.15	96	5.05	854	6.95	2,494	8.85	6,143
3.20	104	5.10	885	7.00	2,550	8.90	6,272
3.25	112	5.15	915	7.05	2,618	8.95	6,401
3.30	120	5.20	946	7.10	2,686	[a] 9.00	6,530
3.35	128	5.25	976	7.15	2,754	9.05	6,692
3.40	136	5.30	1,006	7.20	2,822	9.10	6,854
3.45	144	5.35	1,037	7.25	2,890	9.20	7,178
3.50	152	5.40	1,067	7.30	2,958	9.30	7,502
3.55	167	5.45	1,098	7.35	3,026	9.40	7,826
3.60	182	5.50	1,128	7.40	3,094	9.50	8,150
3.65	198	5.55	1,167	7.45	3,162	9.60	8,524
3.70	213	5.60	1,206	7.50	3,230	9.70	8,898
3.75	228	5.65	1,246	7.55	3,318	9.80	9,272
3.80	243	5.70	1,285	7.60	3,406	9.85	9,459
3.85	258	5.75	1,324	7.65	3,494	9.90	9,646
3.90	274	5.80	1,363	7.70	3,582	10.00	10,020
3.95	289	5.85	1,402	7.75	3,670	10.10	10,456
4.00	304	5.90	1,442	7.80	3,758	10.20	10,892
4.05	328	5.95	1,481	7.85	3,846	10.30	11,328

Rating table for Catskill Creek at South Cairo, N. Y., etc.—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
10.40	11,764	11.80	19,200	13.30	31,680	14.80	49,080
10.50	12,200	11.90	19,800	13.40	32,840	14.90	50,240
10.60	12,700	12.00	20,400	13.50	34,000	15.00	51,400
10.70	13,200	12.10	21,160	13.60	35,160	15.10	52,560
10.80	13,700	12.20	21,920	13.70	36,320	15.20	53,720
10.90	14,200	12.30	22,680	13.80	37,480	15.30	54,880
11.00	14,700	12.40	23,440	13.90	38,640	15.40	56,040
11.10	15,240	12.50	24,200	14.00	39,800	15.50	57,200
11.20	15,780	12.60	25,000	14.10	40,960	15.60	58,360
11.30	16,320	12.70	25,800	14.20	42,120	15.70	59,520
11.40	16,860	12.80	26,600	14.30	43,280	15.80	60,680
11.50	17,400	12.90	27,400	14.40	44,440	15.90	61,840
11.60	18,000	13.00	28,200	14.50	45,600	16.00	63,000
11.65	18,300	13.10	29,360	14.60	46,760		
11.70	18,600	13.20	30,520	14.70	47,920		

[a] Extension by logarithmic diagram above 9.1.

Mean daily discharge, in second-feet, of Catskill Creek at South Cairo, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	33	65	55	46	42
2	.....	.....	.....	.....	.....	.....	.....	37	72	50	46	42
3	.....	.....	.....	.....	.....	.....	.....	33	107	46	42	42
4	.....	.....	.....	.....	.....	.....	50	24	117	46	44	120
5	.....	.....	.....	.....	.....	.....	63	24	80	44	44	120
6	.....	.....	.....	.....	.....	.....	120	29	65	44	42	123
7	.....	.....	.....	.....	.....	.....	182	128	62	39	46	125
8	.....	.....	.....	.....	.....	.....	188	80	63	42	46	120
9	.....	.....	.....	.....	.....	.....	128	62	62	37	42	128
10	.....	.....	.....	.....	.....	.....	85	57	56	42	42	1,037
11	.....	.....	.....	.....	.....	.....	158	53	55	37	42	613
12	.....	.....	.....	.....	.....	.....	144	42	50	37	44	522
13	.....	.....	.....	.....	.....	.....	107	33	53	42	55	289
14	.....	.....	.....	.....	.....	.....	72	29	48	55	75	2,495
15	.....	.....	.....	.....	.....	.....	59	29	46	88	59	(a)
16	.....	.....	.....	.....	.....	.....	63	29	50	96	56	1,206
17	.....	.....	.....	.....	.....	.....	258	24	56	75	53	824
18	.....	.....	.....	.....	.....	.....	237	30	70	70	50	498
19	.....	.....	.....	.....	.....	.....	473	39	70	63	50	304
20	.....	.....	.....	.....	.....	.....	176	44	56	59	50	258
21	.....	.....	.....	.....	.....	.....	101	50	55	56	50	274
22	.....	.....	.....	.....	.....	.....	44	80	55	55	50	304
23	.....	.....	.....	.....	.....	.....	68	107	53	55	46	304
24	.....	.....	.....	.....	.....	.....	72	144	48	55	46	343
25	.....	.....	.....	.....	.....	.....	70	167	44	55	46	144
26	.....	.....	.....	.....	.....	.....	56	104	42	55	46	136
27	.....	.....	.....	.....	.....	.....	46	68	42	50	42	136
28	.....	.....	.....	.....	.....	.....	46	55	46	50	42	152
29	.....	.....	.....	.....	.....	.....	48	46	55	50	42	258
30	.....	.....	.....	.....	.....	.....	42	42	56	46	42	546
31	.....	.....	.....	.....	.....	.....	37	37	.....	46	.....	498

a Above rating table.

Mean daily discharge, in second-feet, of Catskill Creek at South Cairo, N. Y., etc.—Con'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	425	449	18,600	1,037	352	68	149	546	63	1,691	449	182
2	352	a 839	8,823	1,426	289	62	117	1,191	57	1,230	377	191
3	410	a 914	2,217	796	280	55	91	488	50	946	328	243
4	498	a 495	2,328	691	268	56	88	362	49	712	288	391
5	498	a 464	2,106	915	249	62	85	258	49	602	274	304
6	401	a 456	1,067	630	237	62	522	522	46	563	252	304
7	328	a 382	352	498	219	59	401	401	49	498	237	283
8	712	a 374	352	602	213	63	280	280	53	415	222	243
9	213	a 346	449	18,300	182	55	243	243	63	328	198	213
10	167	a 360	946	4,675	152	50	198	198	207	274	167	328
11	136	a 713	1,324	2,528	136	46	182	167	167	283	152	498
12	120	a 444	6,854	1,976	120	42	167	167	117	874	167	367
13	120	a 523	6,272	1,128	117	53	68	144	136	602	192	304
14	120	a 407	3,230	796	107	50	56	96	161	425	161	304
15	104	a 67	1,098	702	104	46	55	104	128	377	152	289
16	120	a 77	3,094	590	80	50	50	96	101	319	136	563
17	104	a 99	7,826	473	72	63	46	80	80	283	136	1,858
18	72	a 102	2,384	425	289	62	42	65	68	252	125	1,085
19	63	a 126	377	401	63	53	46	96	70	243	120	824
20	63	a 164	546	401	68	59	498	88	112	252	117	712
21	88	a 160	304	362	68	55	2,890	75	149	222	120	2,051
22	9,459	a 156	574	352	56	55	1,995	70	123	207	104	5,059
23	1,442	a 95	1,191	314	53	55	2,017	65	101	182	104	2,217
24	712	a 63	1,116	289	63	53	1,691	56	88	192	96	903
25	498	a 81	854	274	68	46	2,659	50	112	182	104	741
26	314	a 87	780	243	59	44	3,026	46	176	152	120	2,051
27	258	a 404	724	249	88	42	328	46	473	167	258	473
28	176	a 3,787	933	219	123	37	401	48	657	1,465	367	401
29	213	.....	1,300	289	112	55	498	59	1,948	1,006	243	367
30	425	.....	1,457	352	93	268	488	70	2,822	657	191	289
31	449	.....	1,067	.....	72	.....	425	85	.....	522	.....	258

a Special ice correction.

Mean daily discharge, in second-feet, of Catskill Creek at South Cairo, N. Y., etc.—Con'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	228	546	2,645	1,324	99	18	376	44	1,360	32	206	120
2	252	449	1,006	854	88	18	258	42	796	32	176	120
3	473	459	685	712	83	18	176	35	574	32	167	115
4	885	1,067	657	685	72	18	139	35	410	28	152	104
5	629	915	602	546	72	18	91	198	314	28	218	104
6	459	512	574	522	68	18	115	249	249	32	263	104
7	343	425	685	483	63	18	80	188	182	32	228	104
8	304	304	1,128	602	59	25	82	139	148	90	176	104
9	182	274	2,495	1,006	55	22	69	101	132	(a)	162	104
10	152	258	1,758	657	52	20	64	88	107	13,700	152	104
11	152	295	3,230	522	46	21	44	72	101	3,160	144	88
12	182	1,285	1,663	425	46	1,442	42	70	88	1,948	136	88
13	144	674	2,051	401	46	1,167	40	65	72	1,324	136	328
14	144	459	946	449	46	522	35	52	65	1,006	136	546
15	152	377	780	1,402	46	1,167	34	47	63	812	132	400
16	141	319	685	1,663	42	1,006	29	46	54	701	120	243
17	152	213	557	930	37	546	61	42	76	657	766	243
18	125	158	507	629	37	473	32	37	128	766	629	212
19	85	222	449	522	37	328	46	37	101	612	462	152
20	109	182	449	425	33	376	47	120	70	556	411	1,760
21	401	222	401	362	29	2,686	50	67	56	506	297	1,520
22	657	198	2,162	314	29	1,805	46	56	54	449	263	601
23	522	131	6,692	289	26	1,418	46	50	50	440	243	590
24	522	152	3,353	289	24	3,094	46	42	46	440	288	473
25	367	131	1,442	243	24	1,442	37	48	42	381	222	497
26	182	123	976	213	24	915	32	128	37	360	162	449
27	176	112	602	167	24	602	28	104	37	297	148	573
28	192	3,758	602	139	30	425	26	88	37	274	131	590
29	377	.....	574	131	20	449	28	1,363	32	258	120	546
30	1,615	.....	507	112	20	498	44	3,406	32	243	120	546
31	741	.....	2,754	.....	18	.....	54	3,230	.....	243	.....	546

[a] Above rating table.

Estimated monthly discharge of Catskill Creek at South Cairo, N. Y., for 1901–1903.

[Drainage area, 263 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per sq. mile.	Depth in inches.
1901.					
July	473	37	114	0.433	0.50
August	167	24	57	.217	.25
September	117	42	60	.228	.26
October	96	37	53	.201	.23
November	75	42	48	.182	.20
December	2,495	42	400	1.520	1.75
1902.					
January	9,459	63	615	2.337	2.70
February	3,787	63	451	1.714	1.78
March	18,600	304	2,598	9.872	11.38
April	18,300	219	1,398	5.312	5.93
May	352	53	144	.547	.63
June	268	37	61	.232	.26
July	3,026	42	639	2.428	2.80
August	1,191	46	202	.768	.89
September	2,822	46	283	1.075	1.20
October	1,691	152	520	1.976	2.28
November	449	96	199	.756	.85
December	5,059	182	784	2.979	3.44
The year	18,600	37	658	2.510	34.14
1903.					
January	1,615	85	356	1.350	1.56
February	3,758	112	508	1.930	2.01
March	6,692	401	1,407	5.340	6.17
April	1,663	112	567	2.160	2.41
May	99	18	45	.170	.20
June	3,094	18	686	2.610	2.91
July	376	26	74	.280	.32
August	3,406	35	332	1.260	1.45
September	1,360	38	183	.700	.78
October	.....	28	748	2.840	3.27
November	766	120	232	.880	.98
December	1,760	88	390	1.480	1.71

MOHAWK RIVER AT DUNSBACH FERRY, N. Y.

This station is located at the dam of the West Troy Water Company, 9 miles from the mouth of Mohawk River. The station was established March 12, 1898, and a record has been maintained since that date with the exception of the period from April, 1899 to August, 1900.

Records were formerly maintained on Mohawk River at the New York State dam at Rexford Flats and at Freeman's bridge, Schenectady, about 4 and 8 miles above Dunsbach Ferry, respectively. Owing to the practical duplication of these records at Dunsbach Ferry gaging station, the Rexford Flats and Freeman's bridge stations were discontinued January 1, 1902.

The left wing of the Dunsbach Ferry dam was injured during the high water of 1902, necessitating a slight change in the discharge calculation. Owing to roughness of the injured portion of the crest, the data are considered somewhat less precise than formerly. During the year 1902 a 66-inch old-pattern American turbine in the adjoining pumping station was replaced by a 54-inch Victor turbine. A record of the effective head of the water wheels and of the extent to which the wheels are run is kept, from which the discharge through the turbines is calculated, and added to the flow over the dam to obtain the total flow of the stream.

SCHOHARIE CREEK AT MILL POINT, N. Y.

This station was established July 6, 1900, to temporarily replace the station at the dam at Schoharie Falls, 1 mile upstream. The station was discontinued September 26, 1903. The record at the dam was interrupted October 10, 1903, by a freshet which carried away part of the dam.

A single discharge measurement was made by E. P. Roundey May 30, 1903. The result showed a discharge of 196 second-feet.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily gage height, in feet, of Schoharie Creek at Mill Point, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.15	2.54	7.93	3.57	1.31	2.20	3.59	2.58	4.76
2	2.25	2.44	4.43	2.87	1.21	2.20	3.49	2.53	4.31
3	2.20	2.64	2.93	2.72	1.16	2.15	3.39	2.48	4.21
4	3.60	3.04	2.78	2.62	1.11	2.10	3.29	2.43	3.46
5	2.90	4.04	2.63	2.67	1.11	2.15	3.19	2.38	3.31
6	2.60	3.54	2.53	2.37	1.06	1.82	3.04	3.38	3.26
7	2.10	3.29	2.63	2.27	1.01	2.20	2.79	3.28	3.21
8	2.05	3.09	3.18	2.27	.86	2.25	2.69	3.28	3.06
9	1.95	2.54	5.33	2.32	.81	2.20	2.64	3.28	2.86
10	1.95	2.24	4.23	2.37	.66	2.25	2.59	3.43	2.71
11	1.90	2.09	5.73	2.27	.46	2.20	2.54	3.38	2.56
12	1.95	4.24	4.28	2.22	.61	2.95	2.49	3.23	2.41
13	2.00	3.14	3.53	2.12	.76	5.45	2.44	2.73	2.41
14	2.00	2.64	3.28	2.12	.46	3.90	2.34	2.58	2.36
15	1.95	2.34	3.03	2.07	.11	4.15	2.29	2.53	2.31
16	1.95	2.24	2.78	3.07	.41	4.65	2.29	2.48	2.26
17	1.90	1.99	2.58	2.57	.86	4.10	2.29	2.48	2.21
18	1.90	1.84	2.53	2.32	.86	3.65	2.24	2.43	2.21
19	1.95	1.79	2.53	2.17	.31	3.55	2.19	2.38	2.16
20	2.05	1.69	2.48	1.92	1.56	3.40	2.24	2.88	2.16
21	2.00	1.64	2.48	1.82	2.46	4.80	2.29	2.83	2.16
22	1.95	1.64	2.63	1.72	1.61	6.30	2.34	2.78	2.11
23	1.95	1.59	5.01	1.67	1.86	5.30	2.39	2.63	2.11
24	1.95	1.54	6.83	1.62	1.81	6.05	2.59	2.48	2.06
25	1.80	1.54	4.13	1.57	2.31	5.35	2.54	2.48	2.11
26	1.70	1.49	3.33	1.52	2.21	4.30	2.44	2.78	2.16
27	1.70	1.49	2.93	1.47	1.81	4.15	2.29	3.48	(a)
28	1.75	1.69	2.58	1.42	2.11	3.95	2.29	3.38	.....
29	1.90	.....	2.53	1.42	2.16	3.40	2.24	4.18	.....
30	4.70	.....	2.48	1.37	2.01	3.50	2.34	5.68	.....
31	3.45	.....	3.98	.....	2.16	.....	2.39	5.38	.....

a End of record.

SCHOHARIE CREEK AT PRATTSVILLE, N. Y.

This station was established November 7, 1902, by C. C. Covert. It is located at the highway bridge at the lower end of the village of Prattsville, N. Y., 1½ miles below the junction of Batavia Kill and Schoharie Creek. The original wire gage was attached to the steel floor beams of the bridge on the upstream side. A standard chain gage was installed July 18, 1903, by F. H. Tillinghast. The gage datum was not changed. The length of the chain from the end of the weight to the marker is 25.74 feet. The gage is read twice each day by James Brennan. Discharge measurements are made from the downstream side of the single-span highway bridge to which the gage is attached. The bridge has a length between abutments of 185 feet. The initial point for soundings is the top of the face of the left abutment at the downstream side of the bridge. The channel is straight for 300 feet above and for 600 feet below the station. At low water the current is

sluggish and discharge measurements are made by wading a short distance below the bridge. Both banks are high enough to prevent overflow. The bed of the stream is composed of gravel. The bench mark is a circle in white paint on a bowlder at the right end of the bridge on the downstream side. Its elevation is 20.97 feet above gage datum, and 1,151 feet above sea level. The top of the gage pulley has an elevation of 25.72 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Schoharie Creek at Prattsville, N. Y., in 1902 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
November 7	C. C. Covert	5.56	342
December 4	F. H. Tillinghast	5.60	345
1903.			
February 5	F. H. Tillinghast	6.60	[a] 1,042
March 10	do	6.92	1,611
May 7	do	5.10	136
May 14	do	5.00	99
May 15	do	5.02	111
June 4	do	4.72	32
June 15	do	8.08	3,200
June 30	do	5.98	652
July 18	do	4.86	55
August 26	do	6.29	806
August 30	do	7.62	2,173

[a] Creek full of ice.

Mean daily gage height, in feet, of Schoharie Creek at Prattsville, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1												5.20
2												5.20
3												5.50
4												5.60
5												5.52
6												5.50
7												5.50
8												5.50
9											5.40	5.45
10											5.40	5.40
11											5.40	5.35
12											5.40	5.30
13											5.35	5.20
14											5.30	5.20
15											5.30	5.20
16											5.30	5.20
17											5.30	7.55
18											5.30	7.20
19											5.20	6.18
20											5.20	6.00
21											5.20	5.95
22											5.20	9.30
23											5.10	7.30
24											5.10	6.43
25											5.35	6.15
26											5.15	6.05
27											5.40	5.90
28											5.55	5.85
29											5.30	5.82
30											5.30	5.72
31												5.72

Mean daily gage height, in feet, of Schoharie Creek at Prattsville, N. Y., etc.—Continued.

Days.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	5.63	5.95	7.72	6.62	5.25	4.75	5.75	4.98	7.10	4.95	5.10	5.00
2	5.65	5.68	6.68	6.18	5.22	4.75	5.58	4.90	6.20	4.98	5.00	5.10
3	6.13	6.65	6.32	6.18	5.22	4.75	5.40	4.90	5.80	4.95	4.95	5.10
4	6.25	6.80	6.12	6.35	5.20	4.75	5.20	4.92	5.50	4.95	4.92	5.10
5	5.85	6.25	6.07	6.10	5.18	4.75	5.20	5.82	5.48	4.95	4.90	5.08
6	5.70	6.05	6.05	6.00	5.10	4.72	5.20	5.85	5.48	5.00	.....	4.95
7	5.70	6.05	5.90	6.00	5.10	4.72	5.18	5.78	5.40	4.98	4.98	4.90
8	5.68	5.90	6.30	6.15	5.10	4.72	5.10	5.45	5.38	6.20	4.92	4.90
9	5.65	5.85	7.38	7.00	5.10	4.85	5.02	5.30	5.25	19.95	4.92	4.88
10	5.65	5.75	7.00	6.40	5.05	4.78	5.00	5.32	5.20	9.80	4.90	4.80
11	5.70	5.70	8.12	6.15	5.08	4.90	5.00	5.22	5.22	8.35	4.88	4.80
12	5.70	6.90	7.25	6.00	5.00	7.88	4.95	5.20	5.20	7.35	4.88	4.80
13	5.65	6.20	6.78	5.88	4.97	7.20	4.90	5.12	5.12	6.55	4.85	4.80
14	5.65	5.80	6.55	5.80	5.00	6.30	4.90	5.10	5.12	6.20	4.80	5.95
15	5.70	5.72	6.78	6.75	5.00	7.25	4.90	5.00	5.02	5.95	4.80	5.80
16	5.70	6.10	6.55	6.45	5.00	7.20	4.85	5.00	5.10	5.70	4.82	5.70
17	5.65	6.15	6.42	6.35	4.95	6.35	4.85	5.00	5.12	5.62	5.42	5.70
18	5.65	6.20	6.25	6.15	4.90	6.05	4.88	5.00	5.88	5.65	5.78	5.60
19	5.65	6.20	6.15	5.98	4.90	5.80	4.95	5.00	5.45	5.62	6.00	5.60
20	5.65	6.20	6.10	5.85	4.85	5.65	5.00	6.55	5.20	5.48	5.65	7.50
21	5.70	6.20	6.22	5.78	4.85	7.05	5.65	6.30	5.18	5.35	5.30	7.35
22	5.78	6.20	8.20	5.68	4.85	6.95	5.58	6.15	5.10	5.30	5.20	6.25
23	5.62	6.25	9.77	5.40	4.85	6.68	5.32	6.08	5.08	5.25	5.22	5.80
24	5.65	6.17	8.40	5.60	4.85	7.62	5.18	5.88	5.05	5.28	5.20	5.70
25	5.61	6.10	7.25	5.50	4.80	6.75	5.02	5.95	5.02	5.25	5.18	5.68
26	6.00	5.95	6.75	5.50	4.80	6.30	4.98	6.15	5.00	5.22	5.25	5.55
27	5.90	6.38	6.38	5.45	4.80	5.95	4.92	5.72	5.00	5.18	5.30	5.35
28	6.30	10.56	6.10	5.38	4.80	5.75	4.90	6.35	5.05	5.18	.....	5.40
29	6.98	.....	6.05	5.32	4.80	5.80	4.92	8.76	5.02	5.18	5.20	5.48
30	7.55	.....	5.90	5.28	4.80	6.18	5.12	7.82	5.00	5.12	5.05	5.62
31	6.22	.....	7.50	.....	4.88	.....	5.02	7.75	.....	5.10	.....	5.60

EAST CANADA CREEK AT DOLGEVILLE, N. Y.

This station was established September 23, 1898. The depth of the crest of the dam and readings of the gate opening of turbines are taken twice daily.

In calculating the record for 1903, special weir coefficients have been utilized, which were derived from experiments on a model of the Dolgeville dam, made at Cornell University hydraulic laboratory in 1903 by the United States Geological Survey.

Mean daily gage height, in feet, of East Canada Creek at Dolgeville, N. Y., for 1903.

Day.	Jan.[a]	Feb.[a]	Mar.[a]	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	669	1,529	3,021	2,512	415	95	1,510	250	736	174	283	93
2	826	1,627	2,317	2,076	394	99	1,220	246	578	182	277	162
3	917	1,129	1,972	2,110	297	80	815	185	457	149	232	219
4	1,211	1,161	1,565	2,590	263	80	662	355	347	97	214	159
5	881	1,639	1,144	1,838	306	100	527	1,249	245	974	196	177
6	939	1,296	1,013	1,496	95	85	561	913	[b] 180	827	405	177
7	752	1,116	991	1,739	257	38	566	938	.....	523	298	151
8	567	865	1,027	2,660	217	112	561	657	229	861	257	129
9	573	641	3,294	2,081	252	199	428	673	123	5,583	262	175
10	583	623	3,203	2,081	[b] 38	422	258	1,018	196	5,973	221	183
11	474	643	7,123	1,765	191	179	182	769	152	3,038	185	201
12	434	1,719	5,526	1,452	191	1,289	175	1,245	124	1,757	196	191
13	516	1,708	4,394	1,279	129	1,740	116	913	([b])	1,223	207	215
14	435	1,440	3,596	1,102	125	1,186	124	716	126	833	196	171
15	414	1,221	3,095	1,028	110	1,047	175	428	149	785	233	216
16	319	886	2,867	988	105	675	248	342	163	633	281	177
17	406	628	2,472	889	[b] 66	605	219	307	112	523	571	202
18	409	591	2,295	788	121	671	190	177	172	1,772	852	175
19	229	485	2,771	741	139	694	296	211	121	1,318	557	199
20	287	583	3,533	696	105	578	363	533	[b] 117	994	587	247
21	338	825	4,686	644	109	1,501	423	461	124	664	455	676
22	1,030	864	4,639	600	109	1,935	440	304	119	625	397	694
23	860	724	5,513	596	109	2,635	661	140	127	546	432	535
24	683	746	6,615	596	[b] 66	3,609	724	159	125	500	384	478
25	595	600	4,128	557	125	1,800	465	740	134	423	371	368
26	851	478	2,725	510	95	1,970	384	2,205	120	381	329	400
27	468	378	2,085	510	101	1,425	390	1,475	[b] 125	364	148	276
28	634	1,036	1,923	447	95	979	263	1,125	134	364	210	238
29	669	.....	1,581	447	95	914	248	954	134	412	163	220
30	1,295	.....	379	415	65	834	390	1,000	123	387	137	236
31	1,296	.....	2,808	.....	[b] 61	.....	316	863	.....	222	.....	238
Mean	666	971	3,042	1,234	156	919	448	695	187	1,068	318	257

[a] Approximate. [b] Sunday.

Estimated monthly discharge of East Canada Creek at Dolgeville, N. Y., for 1903.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.[b]
	Maximum.	Minimum.[a]	Mean.	Second-feet per square mile.	Depth in inches.	
January	1,296	.....	[c] 666	.....	.....	.....
February	1,719	.....	[c] 971	.....	.....	2.38
March	7,123	.....	[c] 3,042	.....	.....	6.75
April	2,660	.....	1,234	4.82	5.40	1.63
May	415	.....	156	.61	.70	.18
June	3,609	.....	919	3.59	4.02	8.68
July	1,510	.....	448	1.75	2.01	5.71
August	2,205	.....	695	2.72	3.13	7.26
September	736	.....	187	.73	.82	1.30
October	5,973	.....	1,068	4.18	4.81	8.34
November	852	.....	318	1.24	1.39	[c] 2.10
December	694	.....	257	1.00	1.15	1.57
The year	.....	.....	.....	.....	.....	.....

[a] One day minimum controlled by pondage.
[b] At Salesbury Inlet.
[c] Approximate, owing to ice obstructions.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

MOHAWK RIVER AT LITTLE FALLS, N. Y.

The gaging station is situated at the dam and mills of the Gilbert Knitting Company and the Little Falls Paper Company, where records of the depth wasted over the dam and of the run of the water wheels are kept. The record at this station was maintained during 1903, but the computation of the discharge has been withheld awaiting the results of experiments made to determine more accurately coefficients for the crest of the dam.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

WEST CANADA CREEK AT TWIN ROCK BRIDGE, N. Y.

This station was established September 7, 1900, by R. E. Horton. The gage readings are furnished by the Utica Gas and Electric Company. The station is located at the highway bridge, 2 miles from Hinckley, N. Y. The gage is a vertical board fastened to the upstream side of the right abutment. It is read twice each day by George Rood. Discharge measurements are made from the two-span bridge to which the gage is attached. The bridge has a total span of

168 feet between abutments. The initial point for soundings is the face of the left abutment on the downstream side. The channel is straight for 500 feet above and for 800 feet below the station. At low water there is a rift about 500 feet below the station. The current is swift and has a well-distributed velocity. Both banks are sufficiently high to prevent overflow, and all water passes beneath the bridge at all stages. The bed of the stream is composed of gravel and cobblestones, with occasional bowlders, and is not subject to change. The bench mark is the corner of the coping of the right abutment at the upstream end of the bridge seat directly over the gage. Its elevation is 15.50 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of West Canada Creek at Twin Rock Bridge, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 21	C. C. Covert	[a] 3.80	[b] 628
February 24	H. R. Beebe	[a] 3.60	[b] 651
February 25	do	[a] 3.54	[b] 625
Do	do	[a] 3.51	[b] 616
March 17	C. C. Covert	[f] 4.845	[c] 3,845
March 24	do	12.00	[c] 15,452
Do	do	11.60	[d] 11,908
March 25	do	7.95	[c] 7,529
Do	do	7.90	[c] 7,672
April 1	do	5.65	[c] 4,517
Do	do	5.75	[c] 4,791
May 13	H. H. Halsey	1.05	[c] 362
Do	do	1.05	[c] 393
May 14	C. C. Covert	1.15	[c] 379
May 26	H. H. Halsey	.55	[c] 238
Do	do	.55	[c] 242
June 2	do	.45	[c] 153
Do	do	.50	[c] 161
June 11	do	.52	[c] 201
July 7	C. C. Covert	1.675	[c] 670
August 21	E. P. Roundey	2.40	[c] 775
August 22	do	2.00	[c] 615
September 28	H. H. Halsey	.80	[e] 301

[a] Measurements made under ice with average thickness of 1.5 feet.
[b] Creek covered with ice 1 foot 2 inches thick.
[c] Discharge slightly affected by log jam.
[d] Surface velocity used.
[e] Normal.
[f] Slight reduction in discharge March 16 to August 31, inclusive, due to log jam in stream.

Mean daily discharge, in second-feet, of West Canada Creek at Twin Rock Bridge, N. Y., for 1900–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	305	330	700
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	270	700	885
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	240	415	1,010
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	255	392	925
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	225	440	808
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	210	770	668
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	240	3,433	570
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	305	3,095	570
9	.....	.....	.....	.....	.....	.....	.....	.....	162	270	1,863	635
10	.....	.....	.....	.....	.....	.....	.....	.....	156	330	602	635
11	.....	.....	.....	.....	.....	.....	.....	.....	162	305	1,048	635
12	.....	.....	.....	.....	.....	.....	.....	.....	156	255	925	635
13	.....	.....	.....	.....	.....	.....	.....	.....	162	225	668	635
14	.....	.....	.....	.....	.....	.....	.....	.....	162	490	700	635
15	.....	.....	.....	.....	.....	.....	.....	.....	168	515	635	400
16	.....	.....	.....	.....	.....	.....	.....	.....	280	415	635	400
17	.....	.....	.....	.....	.....	.....	.....	.....	182	392	635	400
18	.....	.....	.....	.....	.....	.....	.....	.....	151	370	845	400
19	.....	.....	.....	.....	.....	.....	.....	.....	151	350	4,562	400
20	.....	.....	.....	.....	.....	.....	.....	.....	735	440	4,319	400
21	.....	.....	.....	.....	.....	.....	.....	.....	1,731	232	4,319	400
22	.....	.....	.....	.....	.....	.....	.....	.....	1,280	225	3,319	400
23	.....	.....	.....	.....	.....	.....	.....	.....	635	1,241	2,555	480
24	.....	.....	.....	.....	.....	.....	.....	.....	350	1,356	1,010	460
25	.....	.....	.....	.....	.....	.....	.....	.....	415	808	5,515	440
26	.....	.....	.....	.....	.....	.....	.....	.....	330	770	5,450	430
27	.....	.....	.....	.....	.....	.....	.....	.....	350	1,437	3,263	420
28	.....	.....	.....	.....	.....	.....	.....	.....	370	968	2,347	400
29	.....	.....	.....	.....	.....	.....	.....	.....	305	440	925	400
30	.....	.....	.....	.....	.....	.....	.....	.....	330	465	770	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	635	.....	.....
Mean	.....	.....	.....	.....	.....	.....	.....	.....	396	483	1,882	558

Mean daily discharge, in second feet, of West Canada Creek at Twin Rock Bridge, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	400	600	600	3,536	4,650	2,060	280	880	600	310	170	320
2	400	600	600	3,624	4,320	1,660	270	880	620	290	170	380
3	400	600	600	3,305	3,740	2,150	410	450	570	310	360	400
4	400	600	600	2,307	3,000	1,470	310	390	520	290	290	340
5	400	600	600	2,449	900	2,400	300	450	470	290	420	320
6	490	600	600	2,202	830	3,480	600	500	440	270	430	320
7	490	600	600	1,426	640	3,040	540	540	280	330	460	320
8	490	600	600	1,140	550	2,280	510	760	260	300	410	290
9	460	600	610	1,332	500	830	480	1,040	340	300	420	290
10	460	600	620	1,404	640	900	410	1,510	170	220	330	700
11	420	600	610	1,633	1,700	740	380	510	170	250	360	1,360
12	420	600	600	1,449	2,450	590	510	700	250	250	430	1,260
13	420	600	560	1,197	2,060	570	460	670	640	370	520	1,160
14	420	600	540	2,191	1,200	450	300	620	540	1,320	1,330	760
15	420	600	640	2,191	900	300	190	510	460	850	1,330	34,350
16	440	600	1,306	1,967	720	300	170	470	800	800	1,400	8,490
17	440	600	921	1,463	1,200	280	160	440	640	720	1,280	7,940
18	420	600	950	1,376	1,430	280	640	440	510	580	1,260	5,710
19	420	600	806	2,123	1,200	300	540	330	530	550	500	5,580
20	600	600	836	2,232	1,280	1,200	390	220	740	520	410	5,190
21	600	600	883	2,965	1,370	760	330	260	620	470	440	5,190
22	600	600	939	2,698	1,260	900	180	260	450	460	360	2,108
23	600	600	1,383	2.436	1,260	1,660	200	220	400	410	340	1,318
24	600	600	1,512	2,668	760	900	190	260	280	470	320	1,183
25	600	600	2,795	2,475	580	540	230	460	230	480	350	1,010
26	600	600	3,275	2,673	560	410	290	330	260	460	360	1,010
27	600	600	2,736	2,700	560	330	430	300	300	270	480	1,010
28	600	600	4,785	9,116	640	290	600	190	280	270	380	1,010
29	600	.....	3,698	8,060	1,200	270	1,160	190	290	250	330	1,010
30	600	.....	3,366	4,692	1,300	300	1,430	150	280	270	300	1,010
31	600	.....	4,492	.....	1,300	.....	740	180	.....	180	.....	1,010
Mean	497	600	1,408	2,698	1,441	1,054	439	487	431	422	531	2,976

Mean daily discharge, in second feet, of West Canada Creek at Twin Rock Bridge, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	560	520	3,839	3,665	4,198	1,126	1,911	668	370	1,241	1,911	700
2	560	520	6,260	2,711	2,763	1,087	2,151	635	330	542	1,202	684
3	560	560	7,488	1,959	1,863	1,010	3,839	635	280	542	1,280	1,521
4	560	560	5,710	1,318	1,959	2,295	6,612	586	255	465	602	3,433
5	560	560	4,441	1,337	2,295	1,521	3,319	502	330	490	635	2,711
6	560	560	3,095	1,241	1,521	968	2,399	845	415	478	885	2,659
7	560	560	2,555	1,280	1,605	1,356	1,437	1,395	415	478	1,202	3,433
8	560	560	2,103	1,298	1,241	1,087	1,437	1,260	602	1,815	1,048	968
9	560	560	2,199	4,501	1,087	770	1,337	1,563	845	2,103	925	770
10	560	560	1,911	4,258	1,087	1,087	1,280	1,521	770	1,563	735	788
11	560	560	1,887	2,451	885	1,935	1,087	1,318	668	718	635	740
12	560	560	2,295	2,223	770	845	651	1,959	392	570	735	740
13	560	560	4,076	2,247	602	1,356	515	1,318	370	515	1,815	640
14	560	560	6,330	2,451	502	1,202	490	968	440	502	2,007	550
15	560	560	4,016	1,605	370	1,773	845	770	381	465	1,164	600
16	560	520	4,813	1,395	370	1,731	2,815	602	330	478	1,087	820
17	560	520	8,410	1,479	440	1,395	1,318	570	330	370	1,280	2,700
18	560	[a] 500	6,540	1,356	528	925	1,144	515	270	270	1,106	2,460
19	560	[a] 440	6,901	1,280	528	718	925	668	225	1,202	808	1,220
20	560	[a] 420	6,365	1,395	602	808	1,647	618	195	2,503	718	880
21	560	[a] 410	2,295	1,202	586	845	2,955	700	240	3,095	770	720
22	520	[a] 400	2,007	2,007	556	2,451	4,076	770	225	2,607	885	2,840
23	490	520	2,607	1,605	515	1,773	3,123	752	225	2,055	1,087	2,950
24	490	[a] 420	2,503	1,395	1,563	1,318	1,773	618	225	2,031	602	2,180
25	520	[a] 410	2,223	1,437	2,295	925	1,395	515	232	1,164	718	1,760
26	520	[a] 440	2,031	1,280	2,031	2,199	770	428	262	1,395	635	1,230
27	520	[a] 360	1,863	1,911	1,689	3,151	586	370	370	1,815	718	1,160
28	520	510	2,199	2,103	1,479	1,959	808	305	465	4,198	1,164	1,070
29	520	.....	5,580	1,337	1,395	1,437	968	290	1,395	5,840	1,087	1,480
30	520	.....	8,015	2,983	1,647	2,503	735	262	2,247	3,151	808	1,480
31	520	.....	5,190	.....	1,911	.....	602	415	.....	3,549	.....	1,420
Mean	545	520	4,121	1,957	1,318	1,452	1,772	785	467	1,555	1,008	1,510

[a] Doubtful.

Mean daily discharge, in second-feet, of West Canada Creek at Twin Rock Bridge, N. Y., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	1,070	2,370	6,000	4,702	1,468	210	885	700	602	370	905	160
2	1,120	2,570	3,960	3,334	1,741	182	1,826	635	490	465	845	184
3	1,420	1,700	1,480	3,820	700	195	1,546	392	465	570	770	244
4	2,250	1,070	1,880	8,440	602	173	1,162	542	1,280	635	684	184
5	1,940	1,210	1,420	4,110	515	182	905	2,616	465	845	770	206
6	2,100	970	840	3,010	465	173	1,314	2,344	415	515	905	342
7	1,760	970	840	2,198	542	270	808	2,175	290	1,010	845	308
8	1,760	1,480	1,220	4,400	542	232	885	1,468	173	1,815	826	316
9	1,160	1,760	2,970	3,469	465	210	925	1,086	173	7,638	700	299
10	1,160	1,820	3,560	4,430	515	225	490	1,124	173	16,100	668	316
11	1,160	2,000	4,840	3,820	490	218	255	1,741	280	5,980	668	316
12	1,160	2,060	6,540	2,794	515	1,873	232	6,092	1,126	4,380	700	285
13	1,320	2,370	3,700	2,641	370	2,902	232	3,280	370	2,295	700	351
14	1,370	2,370	3,700	2,443	202	1,488	262	1,585	370	2,055	635	351
15	1,320	1,650	1,370	3,064	202	2,294	262	1,448	370	1,815	635	395
16	1,220	1,760	3,880	2,740	270	1,124	392	1,162	350	1,087	651	465
17	1,220	970	3,540	2,198	370	1,488	232	1,048	210	1,356	1,029	299
18	1,220	1,220	3,500	2,740	651	668	262	718	925	5,320	2,103	368
19	920	1,270	4,600	1,162	770	1,048	262	370	635	4,319	1,605	508
20	880	760	5,900	2,492	370	542	415	1,048	465	2,347	1,479	257
21	920	700	8,480	845	270	1,780	240	1,124	490	1,911	1,356	611
22	1,220	560	9,640	1,780	248	5,801	845	1,010	668	1,521	1,126	704
23	1,260	800	10,810	556	290	3,110	2,767	752	465	1,318	1,048	746
24	1,060	1,070	12,940	668	370	2,106	3,280	570	360	1,318	546	536
25	970	600	7,700	668	225	3,118	1,966	1,048	415	1,280	299	724
26	920	400	4,720	1,546	218	2,592	1,010	4,255	330	1,280	160	465
27	840	480	3,000	580	240	2,100	3,280	2,443	350	1,010	206	324
28	840	1,320	2,500	868	225	2,443	1,507	1,780	370	885	270	359
29	880	.....	2,960	900	232	968	602	968	415	845	270	584
30	1,640	.....	2,790	668	225	845	1,238	946	370	845	206	809
31	2,050	.....	2,700	.....	248	.....	668	602	.....	788	.....	831
Mean	1,294	1,367	4,321	2,534	470	1,352	998	1,518	462	2,386	787	415

Estimated monthly discharge of West Canada Creek at Twin Rock Bridge, N. Y., for 1900–1903.

[Drainage area, 364 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1900.					
September	1,731	151	396	1.08	1.20
October	1,437	210	483	1.32	1.52
November	5,515	330	1,882	5.17	5.77
December	1,010	400	558	1.52	1.75
1901.					
January	600	400	497	1.36	1.57
February	600	600	600	1.65	1.72
March	4,785	540	1,408	3.87	4.46
April	9,116	1,140	2,698	7.42	8.28
May	4,650	500	1,441	3.96	4.57
June	3,480	270	1,054	2.90	3.24
July	1,430	160	439	1.21	1.39
August	1,510	150	487	1.34	1.54
September	740	170	431	1.18	1.32
October	1,320	180	422	1.16	1.34
November	1,400	170	531	1.46	1.63
December	34,350	290	2,976	8.19	9.44
The year	34,350	150	1,082	2.98	40.50
1902.					
January	560	490	545	1.49	1.72
February	560	360	520	1.43	1.48
March	8,410	1,863	4,121	11.33	13.06
April	4,501	1,202	1,957	5.39	6.01
May	4,198	370	1,318	3.63	4.18
June	3,151	718	1,452	3.98	4.44
July	6,612	490	1,772	4.86	5.60
August	1,959	262	785	2.16	2.49
September	2,247	195	467	1.28	1.43
October	5,840	270	1,555	4.29	4.94
November	2,007	602	1,008	2.77	3.09
December	3,433	550	1,510	4.15	4.78
The year	8,410	195	1,418	4.06	53.22

Estimated monthly discharge of West Canada Creek at Twin Rock Bridge, N. Y., etc.—Con'd.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square miles.	Depth in inches.
1903.					
January	2,250	840	1,294	3.56	4.10
February	2,570	400	1,367	3.76	3.91
March	12,940	840	4,321	11.88	13.69
April	8,440	556	2,534	6.96	7.76
May	1,741	202	470	1.29	1.49
June	5,801	173	1,352	3.72	4.15
July	3,280	232	998	2.74	3.16
August	6,092	370	1,518	4.16	4.79
September	1,280	173	462	1.27	1.42
October	16,100	370	2,386	6.56	7.56
November	2,103	206	787	2.16	2.41
December	831	160	415	1.14	1.31
The year	16,100	160	1,492	4.10	55.75

MOHAWK RIVER AT UTICA, N. Y.

The drainage area of Mohawk River above Rome is exceptionally rugged and precipitous. There are, however, in the region of the headwaters, sand areas which feed the stream in summer from ground storage. From Rome to Little Falls, a distance of 36 miles, the stream flows through a broad, flat valley overflowering its banks during freshets, and passing over a rock barrier with 40 feet fall at Little Falls.

This stream receives water from the Black River drainage basin through Black River canal at Rome and from Chenango River drainage basin through Oriskany Creek at Oriskany. There is also a diversion to supply the Erie Canal at Rome and Oriskany, and wastage is returned to the river from the canal at various points. The discharge at Utica does not represent the natural flow of the river during the navigation season. The station which was located at the Genesee street bridge, Utica, N. Y., was discontinued May 1, 1903, on account of changes which are being made in the river channel.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Mohawk River at Utica, N. Y. (Genesee street), in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 3	C. C. Covert	7.35	[a]3,196
March 2	do	9.00	5,354
March 10	do	9.14	5,930

[a] Snow and ice along banks of stream; river frozen across 400 feet above bridge.

Mean daily discharge, in second-feet, of Mohawk River at Utica, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	445	4,160	10,720	3,025	17	673	1,140	2,850	1,186
2	729	3,788	5,295	2,520	18	.....	900	2,920	1,110
3	930	3,238	4,048	1,670	19	645	900	2,885	.....
4	2,260	3,504	3,276	2,200	20	562	945	2,920	841
5	2,380	4,160	2,885	2,560	21	645	870	2,823	757
6	1,828	3,996	2,742	1,900	22	990	.....	2,796	799
7	1,140	3,130	2,688	1,294	23	990	870	3,238	575
8	1,020	2,500	3,736	2,796	24	785	930	5,895	445
9	729	1,390	.....	3,095	25	701	900	8,632	458
10	701	1,326	5,210	2,661	26	701	729	3,130	673
11	.....	1,294	7,300	2,607	27	.....	.....	2,560	589
12	813	2,085	6,700	1,140	28	617	2,200	2,200	445
13	785	2,885	4,048	.....	29	813	.....	2,320	382
14	757	3,095	3,466	975	30	2,990	.....	1,810	308
15	757	2,400	3,025	1,170	31	3,736	.....	2,280	.....
16	701	1,740	2,920	1,232					

STARCH FACTORY CREEK NEAR NEW HARTFORD, N. Y.

A gaging weir was established May 26, 1903, above the head of the former Savage reservoir by the Consolidated Water Company, by whom the records have been furnished. The weir has a horizontal iron crest 6 feet long, with end contractions. The gage is located 6 feet upstream from the weir, and readings are taken twice each day. The discharge has been calculated by the Francis formula. During freshets part of the water flows in the channel of the stream, passing around the weir. At such stages the discharge is measured at a masonry intake dam a short distance downstream. The bench mark to which the weir gage has been referred is a nail in a large maple tree 150 feet from the left end of the weir. Its elevation is 1.20 feet above the zero of the gage, which is set at the level of the crest of the weir. Two high-water discharge measurements were made during 1903. The first, made in March, showed a discharge of 367 second-feet; the second, made October 10, showed a discharge of 313 second-feet.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Starch Factory Creek near New Hartford, N. Y., for 1903.[a]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.41	8.29	1.00	4.55	0.74	2.89	1.22
2	.....	.41	2.64	.95	2.89	1.47	2.17	1.10
3	.....	.41	1.59	.89	2.48	.79	1.16	1.10
4	.....	.41	1.47	12.50	1.84	.79	1.10	1.10
5	.....	.41	4.57	7.61	1.47	13.62	1.34	1.10
6	.....	.41	4.05	4.27	1.34	1.96	1.40	1.10
7	.....	.48	1.78	3.82	1.10	1.40	1.40	1.10
8	.....	2.21	1.34	1.78	1.00	39.60	1.40	1.10
9	.....	.72	1.10	19.76	.95	87.00	1.22	1.10
10	.....	.72	.89	4.25	1.00	39.00	1.22	1.41
11	.....	.57	.84	27.20	1.59	9.34	1.22	1.28
12	.....	14.34	.84	6.43	1.05	5.24	1.22	1.60
13	.....	2.99	.84	2.88	1.00	4.36	1.16	2.88
14	.....	1.21	2.93	1.84	.89	3.21	1.10	4.65
15	.....	4.88	1.10	1.34	.89	2.64	1.10	2.80
16	.....	6.98	3.42	1.00	.79	2.34	2.62	2.34
17	.....	11.30	1.16	1.00	3.08	3.30	13.83	2.09
18	.....	6.05	.84	1.00	1.34	11.59	4.56	1.96
19	.....	3.64	1.40	.95	.94	5.92	2.80	1.72
20	.....	2.21	1.34	4.55	.79	5.73	2.64	3.50
21	.....	45.25	4.17	1.65	.79	4.74	2.34	10.75
22	.....	9.62	2.15	1.10	.79	3.90	2.22	6.02
23	.....	9.55	3.04	1.00	.79	3.56	2.15	4.56
24	.....	8.31	2.97	.89	.68	2.64	3.29	3.82
25	.....	11.50	1.47	38.50	.63	3.64	2.80	7.47
26	0.45	6.16	1.40	5.63	.68	3.46	2.42	3.72
27	.48	3.13	1.00	3.04	1.08	3.12	1.96	3.30
28	.56	2.15	.89	2.09	.79	3.29	1.96	2.72
29	.48	1.72	2.19	17.50	.68	3.29	1.66	2.22
30	.48	5.49	1.40	6.84	.68	3.29	1.34	1.96
31	.48	.....	1.22	10.57	.....	3.38	.....	1.72
Mean	.48	5.45	2.08	6.25	1.29	8.98	2.32	2.73

[a] Maximum discharge approximate. Actual flow not including diversion.

Estimated monthly discharge of Starch Factory Creek near New Hartford, N. Y., for 1903.

[Drainage area, 3.40 square miles.]

Month.	Discharge in second-feet.			Corrected run-off.			Rainfall, in inches.
	Maximum.	Minimum.	Mean.	Second-feet.	Second-feet per square mile.	Depth in inches.	
May 26–31	0.61	0.45	0.48	1.25	0.368	0.43	.....
June	62.00	.37	5.45	6.22	1.829	2.04	8.49
July	11.55	.84	2.08	2.85	.838	.97	4.92
August	52.00	.84	6.25	7.02	2.064	2.37	5.90
September	5.43	.63	1.29	2.06	.606	.68	1.12
October	87.00	.74	8.98	9.75	2.866	3.31	7.40
November	17.31	1.05	2.32	3.09	.908	1.01	2.09
December	12.30	1.05	2.73	3.50	1.029	1.19	2.54

Daily precipitation, in inches, at Savage reservoir (No. 3)[a] near Utica, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1							0.24			0.13		
2										.20		
3				0.18			.02					
4	0.61			.39				1.03				
5			0.41				.58	.29		1.05	0.51	
6					0.03		.19	.20			.18	
7				.48	.15			.21		.02		
8				.30		0.47				1.50		0.13
9			.92	.02				.68		2.00		
10		1.40	.11	.27		.26				.95		1.20
11			.96			.23		.34	0.32			
12	1.04					3.04						
13	.22											.28
14						.38	.85					.05
15				.28		.27						.05
16		.71				.44	.37					
17	.17	.66	.21	.16		.62			.64		.90	
18						.15			.10	.89	.14	.05
19							.28			.11	.08	
20						.10	.20	.76				
21			.60			2.08	.51					.51
22	.90		.66				.21					
23			.46	.02		.31	.52			.21		.08
24		.78	.88			.11					.41	
25			.9	.01		.57		1.16				.09
26	.27		.73				.51	.29	.23		.09	.04
27			.5						.14			.06
28	.13	.17	.21		.10					.32		
29			.22			.19	.47	.49				
30						.53	.18	.18				
31	.07		.86					.24				.12
Total	3.41	3.72	6.83	2.11	.28	9.75	5.13	5.87	1.43	7.38	2.31	2.66

[a] Small rain gage, except December.

Precipitation, in inches, at Savage reservoir (No. 3), Utica, N. Y.[a]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1880	3.60	1.90	1.62	1.33	4.54	2.51	3.80	5.27	4.11	5.89	3.54	1.06	39.17
1881	1.90	2.67	2.08	.60	3.69	2.59	3.83	1.56	2.51	6.67	4.22	8.72	41.04
1882	2.63	2.04	4.78	1.39	5.12	7.52	3.62	1.62	3.22	1.25	2.28	3.38	38.85
1883	1.85	3.03	.66	.71	4.26	5.38	5.10	1.21	4.16	3.61	3.89	2.42	36.28
1884	2.90	4.84	4.02	1.31	4.95	1.13	2.84	3.38	2.62	4.28	2.86	5.06	40.19
1885	2.32	2.26	.76	1.92	4.26	3.09	6.68	7.04	2.14	7.95	4.99	3.76	47.17
1886	2.42	1.33	3.36	3.06	2.63	3.41	6.37	2.51	5.98	3.69	7.10	1.72	43.58
1887	4.65	7.04	2.76	2.49	2.28	2.06	4.05	3.68	2.50	1.96	4.05	4.06	41.58
1888	3.35	2.98	4.62	2.87	4.09	4.55	1.56	3.85	3.62	5.52	4.90	3.12	45.03
1889	4.32	4.04	3.25	2.71	2.49	9.19	5.49	1.72	3.98	3.91	3.83	3.31	48.19
1890	4.96	4.82	3.81	3.30	8.72	4.76	3.25	5.18	7.40	6.65	6.37	4.79	64.01
1891	4.68	3.20	3.40	1.87	1.69	2.91	3.27	3.55	2.51	2.92	3.94	6.40	40.34
1892	6.57	4.38	9.86	1.09	6.49	4.73	6.76	9.29	3.12	3.03	4.11	1.90	61.33
1893	2.03	8.32	2.45	2.74	7.84	1.53	4.25	8.50	3.95	1.65	2.42	4.40	49.63
1894	2.21	4.17	3.10	2.48	5.89	3.95	3.69	3.68	4.70	5.46	2.73	2.82	44.88
1895	4.89	3.13	1.20	2.81	3.17	2.07	4.37	5.31	3.48	.62	4.83	5.09	40.97
1896	1.40	6.28	6.61	.08	2.62	4.87	5.74	1.95	3.48	3.42	4.54	2.66	43.65
1897	2.71	1.73	4.24	3.37	4.97	5.14	6.01	4.70	3.52	.87	7.19	3.80	48.25
1898	5.65	2.45	2.38	4.37	5.73	3.59	2.24	9.51	3.67	4.68	4.29	2.25	50.81
1899	1.83	2.42	4.08	2.06	3.97	2.32	4.30	3.30	2.51	2.93	2.51	3.88	36.11
1900	4.33	5.40	5.75	1.72	1.62	3.48	6.04	3.02	1.61	3.51	6.24	4.53	47.25
1901	2.72	.95	3.43	4.92	5.43	5.43	4.89	2.84	2.28	3.29	4.66	5.99	46.85
1902	1.26	4.92	3.52	1.92	5.12	6.35	8.89	3.38	4.79	5.68	2.49	4.50	52.82
1903	3.41	3.72	6.83	2.11	.28	9.75	5.13	5.87	1.43	7.38	2.31	2.66	51.08
Mean													45.80

[a] Four-inch gage standing on ground at elevation of about 700 feet above tide on south slope of Mohawk River.

REELS CREEK NEAR DEERFIELD, N. Y.

The drainage area of Reels Creek lies on the north slope of the Mohawk River basin. The tributaries are numerous and the valleys are deep, with gravel or sodded slopes, which favor a rapid discharge of flood water. The record of the discharge of this stream was begun at the waterworks-intake dam January 1, 1901. In order to secure a more accurate record during periods of diversion, a weir was constructed on the shale stream bed just above the intake dam. Readings have been taken twice each day on this weir since August 29, 1903. The record of the precipitation has been observed by means of a standard rain gage at the Deerfield Reservoir. The drainage area of Reels Creek above the weir is 4.4 square miles, and above its mouth 9.4 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Reels Creek near Deerfield, N. Y., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.9	17.6	17.6	20.6	(b)	0.31	35.0	0.48	6.93	2.49	4.96	3.28
2	4.9	14.2	14.2	20.6	(b)	.31	3.12	.39	6.71	2.49	3.44	3.21
3	26.5	10.5	14.2	42.3	(b)	.31	2.48	.39	6.38	2.49	3.28	3.21
4	12.0	18.8	14.2	20.6	(b)	.31	2.48	.39	6.38	2.36	3.36	3.21
5	10.5	17.6	10.5	12.0	(b)	.31	2.17	5.4	6.38	6.71	11.16	3.21
6	7.8	17.6	10.5	9.0	(b)	.31	2.17	3.12	6.38	5.65	7.70	3.21
7	5.4	17.6	10.5	256.5	(b)	.31	1.88	5.4	5.86	3.69	4.12	3.21
8	5.4	14.2	247.2	87.0	(b)	.31	1.62	3.12	5.65	8.15	4.12	3.21
9	4.9	10.5	87.0	30.6	(b)	.17	1.48	3.12	5.54	15.58	3.69	3.21
10	4.9	10.5	20.6	20.6	(b)	.31	1.36	5.4	5.34	9.75	3.52	3.36
11	4.4	7.8	120.8	20.6	(b)	.23	1.36	2.79	5.14	6.72	3.21	3.36
12	4.4	12.0	20.6	9.0	(b)	59.85	1.11	8.72	4.96	7.48	3.21	3.36
13	4.4	14.2	20.6	9.0	(b)	14.77	.88	3.8	4.76	6.17	3.21	4.57
14	4.4	10.5	20.6	5.4	(b)	3.12	.67	2.48	4.57	5.54	3.21	3.95
15	4.4	7.8	12.0	20.6	(b)	2.63	.48	1.36	4.38	5.24	3.95	3.52
16	4.4	6.6	12.0	30.6	0.39	.98	.31	1.20	4.38	5.14	9.75	3.21
17	4.4	6.6	20.6	12.0	.39	87.0	.31	.88	4.04	5.86	14.76	3.21
18	4.4	5.4	12.0	9.0	.39	3.8	.31	.88	3.78	8.83	4.96	3.21
19	4.4	5.4	9.0	5.4	.39	12.7	.31	.88	3.52	8.60	3.44	3.21
20	4.4	5.4	5.4	5.4	.39	2.96	.31	3.12	3.14	8.60	3.36	5.14
21	10.5	5.4	5.4	4.3	.39	295.8	2.03	1.36	2.75	8.60	3.36	5.76
22	7.8	5.4	72.0	4.3	.39	209.1	42.4	1.36	2.36	8.60	3.36	5.14
23	6.6	5.4	121.7	2.2	.39	209.1	2.48	3.14	2.36	8.15	3.36	4.66
24	6.6	5.4	71.2	1.8	.39	161.0	1.36	2.82	2.36	9.40	3.36	6.38
25	5.4	5.4	30.6	1.8	.39	62.0	.48	(c)	2.36	8.94	3.36	5.34
26	5.4	5.4	20.6	1.5	.39	7.2	2.17	18.3	2.36	8.60	4.04	4.96
27	5.4	4.9	35.2	1.1	.39	5.4	1.36	11.35	2.62	8.26	3.86	4.96
28	5.4	202.4	68.6	.9	.35	4.4	.39	7.48	2.62	8.04	3.52	4.76
29	20.6	.....	33.7	(d)	.35	3.9	.88	21.6	2.62	7.82	3.36	4.38
30	20.6	.....	20.6	(d)	.35	3.4	1.36	8.15	2.62	7.48	3.36	4.20
31	12.0	.....	39.8	.....	.35	.....	.57	8.15	.....	7.48	.....	3.36
Mean	7.7	16.8	39.3	23.7	.38	38.41	3.72	4.57	4.31	7.06	4.58	3.97

[a] Record approximate January 1 to August 22, 1903, inclusive.
[b] No record. Stream very low.
[c] Above weir.
[d] No record.

Estimated monthly discharge of Reels Creek near Deerfield, N. Y., for 1901–1903.[a]

[Drainage area, 442 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.[b]
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1901.						
January	102.5	1.3	6.83	1.550	1.79	3.12
February 1–17	1.7	1.3	1.38	.313	.33	1.79
March	49.0	1.3	8.02	1.820	2.10	3.09
April	55.8	1.7	11.81	2.679	3.09	3.58
May	62.7	1.3	8.55	1.948	2.25	4.57
June[c]	209.1	1.7	70.15	.....	.....	5.73
July[c]	37.5	1.3	12.39	.....	.....	3.87
August[c]	132.4	4.5	44.04	.....	.....	2.68
September[c]	32.0	1.3	9.09	.....	.....	4.50
October[c]	15.3	1.3	4.91	.....	.....	2.35
November[c]	30.5	1.3	7.23	.....	.....	2.46
December[c]	124.5	1.3	16.46	.....	.....	4.82
1902.						
January[c]	5.0	1.3	2.5	.....	.....	1.06
February[c]	4.7	1.3	2.1	.....	.....	2.94
March[c]	254.7	2.5	78.9	.....	.....	6.24
April[c]	42.4	1.3	10.8	.....	.....	2.13
May 1–22	13.6	1.1	3.9	.881	1.01	3.93
June	103.0	1.1	13.1	2.974	3.42	6.95
July	206.7	.8	29.8	6.764	7.78	9.15
August	21.6	.4	2.6	.590	.68	4.67
September	71.2	.4	5.0	1.135	1.31	5.81
October	120.8	1.1	11.8	2.679	3.09	5.93
November	7.2	1.1	3.4	.772	.89	2.11
December	19.5	2.2	6.2	1.407	1.63	4.34
1903.						
January	26.5	4.4	7.7	1.74	2.01	2.93
February	202.4	4.9	16.8	3.81	3.97	3.75
March	247.2	5.4	39.3	8.92	10.28	6.75
April	256.5	.9	23.7	.54	.60	2.24
May 16–31	.4	.4	.4	.09	.10	.11
June	295.8	.2	38.4	8.72	9.73	10.72
July	42.4	.3	3.7	.84	.97	2.16
August	21.6	.4	4.6	1.04	1.20	6.78
September	6.9	2.4	4.3	.98	1.09	.97
October	15.6	2.4	7.1	1.60	1.84	9.01
November	14.8	3.2	4.6	1.04	1.16	2.77
December	6.4	3.2	4.0	.90	1.04	[d] 3.57

[a] Record roughly approximate to May, 1902. Approximate, June, 1902, to August 22, 1903. Thin-edged weir, two readings per day, beginning August 23, 1903.
[b] At Deerfield reservoir.
[c] Weekly observations.
[d] 2.39 inches water carried forward December 31, 1903, as snow, leaving net available rainfall of December 1.18 inches.

JOHNSTON BROOK NEAR DEERFIELD, N. Y.

Johnston Brook flows in a deep valley. Its drainage area lies mostly to the north of the stream and is drained by short parallel feeders that head well below the divide and are supplied to some extent from ground storage. It is the first important tributary entering Reels Creek below the waterworks-intake dam. A weir was established on Johnston Brook in August, 1903, by E. H. Fitch. A new gage was put in and the weir was repaired in September, 1903. The weir is located 800 feet above the mouth of the stream and about 4 miles from Deerfield, N. Y. The drainage area above the weir is 0.78 square mile, and above the mouth of the stream is 0.79 square mile.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Johnston Brook near Deerfield, N. Y., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.05	0.22	0.28	0.26	17	.....	.18	.92	4.97	.25
2	.....	.78	.22	.28	.25	18	.....	.30	1.51	1.57	.25
3	.....	.60	.20	.34	.25	19	.....	.25	1.26	.34	.25
4	.....	.60	.18	.34	.25	20	.....	.17	.92	.34	1.38
5	.....	.60	.78	.98	.25	21	.....	.16	.78	.32	1.36
6	.....	(a)	.42	.88	.25	22	.....	.16	.69	.31	.74
7	.....	.....	.26	.42	.30	23	.....	.16	.57	.31	.50
8	.....	.....	5.54	.40	.25	24	.....	.16	.47	.31	.52
9	.....	.....	8.22	.34	.25	25	.....	.16	.44	.32	1.06
10	.....	.....	4.20	.32	.25	26	.....	.16	.40	.34	.69
11	.....	.....	1.68	.31	.25	27	.....	.31	.32	.34	.50
12	.....	.....	1.05	.31	.25	28	1.39	.31	.30	.34	.50
13	.....	.18	.92	.31	.47	29	5.14	.31	.28	.31	.40
14	.....	.18	.74	.31	.32	30	.60	.31	.28	.31	.40
15	.....	.18	.64	.31	.25	31	1.30	.....	.28	.....	.42
16	.....	.18	.60	.54	.25						

a No record September 6 to 12, inclusive.

Estimated monthly discharge of Johnston Brook near Deerfield, N. Y., for 1903.

[Drainage area, 0.79 square mile.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
August 28–31	5.14	0.60	2.11	.....	.....
September	1.05	.16	.32	0.41	0.46
October	8.22	.18	1.14	1.46	1.68
November	4.97	.28	.57	.73	.81
December	1.38	.25	.44	.56	.65

Precipitation, in inches, at Deerfield reservoir near Utica, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1										0.32		
2												
3	0.58			0.52								
4		1.00		.60				1.30		1.21		
5		.05	0.15				0.55	.05			0.25	
6		.03										
7	.50		.08	.82				.32		2.25		
8	.10		.65			1.18				1.00		
9			.50					1.52		.50		
10		.10				.08				1.20		2.00
11	.50	.75	.75			1.30		.60			.07	
12	.08					2.00		.10				
13	.12					.10						.25
14				.05		.32	.22					.10
15	.05			.10							.25	.12
16				.15		1.25				.25	1.10	
17	.15	.25	.10			.23		.04	0.75	1.00		
18		.04				.18	.13					
19										.08	.10	
20						1.00		.75				.55
21		.05	.50			1.18	.32					
22		.03			0.08		.80				.10	.10
23		.05	1.72			.51	.14			1.00	.75	
24			.40							.08	.15	
25			.35			.65		1.75				.25
26												.15
27			.20									
28	.75	1.40	.45		.03				.22			.03
29	.10							.25				.02
30			.40			.74						
31			.50					.10		.12		
Total	2.93	3.75	6.75	2.24	.11	10.72	2.16	6.78	.97	9.01	2.77	3.57

GRAEFENBERG CREEK NEAR NEW HARTFORD, N. Y.

Graefenberg Creek is a tributary to Starch Factory Creek, which enters Mohawk River at Utica, N. Y. Its drainage basin, which has an area of 0.28 square mile, is cleared land, largely meadow and pasture. The basin has an average elevation of 1,200 feet above the sea level, and lies near the summit of the plateau south of Mohawk River. The soil is porous, and the flow is maintained largely by ground-water storage, brought into the stream by tiling. Adjacent streams, which have tributary areas equal to or greater than that of Graefenberg Creek, become dry during the summer. A weir was established above the inflow to Graefenberg reservoir on June 7, 1903, by the Consolidated Water Company, of Utica, N. Y. A standard rain gage was placed not far from the gage. The records have been furnished by the Consolidated Water Company, whose observer is R. O. Salisbury.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Graefenberg Creek near New Hartford, N. Y., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.55	0.85	0.95	0.75	0.90	0.78
2	.....	.95	.80	.91	.89	.85	.78
3	.....	.91	.78	.88	.72	.85	.78
4	.....	.91	2.52	.85	.72	.85	.78
5	.....	1.10	1.19	.81	2.70	1.34	.80
6	.....	1.10	.95	.81	.84	1.00	.80
7	[a] 0.62	.91	.88	.78	.78	.91	.81
8	[a] .62	.91	.85	.78	5.19	.88	.80
9	[a] .62	.88	2.32	.78	15.15	.85	.78
10	[a] .62	.85	1.00	.78	4.02	.85	.88
11	[a] .65	.85	1.78	.81	1.49	.85	.83
12	1.55	.85	1.05	.78	1.20	.85	.86
13	1.00	.85	.88	.78	1.05	.83	1.65
14	.80	.88	.88	.78	1.00	.85	1.05
15	.85	.85	.81	.75	.96	.81	1.00
16	1.05	.88	.81	.72	.91	.85	.98
17	1.52	.85	.78	.81	.91	1.97	.91
18	.95	.85	.78	.81	9.34	1.10	.85
19	.82	.85	.94	.75	9.74	.96	.85
20	.78	.82	1.05	.72	1.14	.91	2.20
21	3.45	1.14	.88	.72	1.00	.91	1.65
22	1.15	.96	.78	.72	.96	.91	1.24
23	1.26	1.40	.78	.72	1.00	.96	1.05
24	1.15	1.00	.78	.72	.91	1.08	1.05
25	1.62	.88	3.50	.72	.91	.96	1.28
26	1.09	.88	1.05	.72	.91	.91	1.08
27	.95	.85	.91	.73	.91	.91	.98
28	.91	.78	.91	.72	.96	.85	.91
29	.91	.88	1.88	.72	.96	.82	.88
30	1.20	.90	1.05	.72	.91	.78	.86
31	.....	.85	1.35	.....	.91	.....	.85
Mean	1.09	.94	1.15	.78	2.25	.94	1.00

[a] Clearing intake, conditions artificial.

Precipitation, in inches, at Graefenberg reservoir near Utica, N. Y., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.62	T.	T.	T.	.....	.....
2	.....	T.	.....	T.	0.35	.....	.....
3	.....	.....	.....	.....	.....	.....	0.08
4	.....	T.	T.	.....	.....	.....	.....
5	.....	.....	1.27	.....	1.20	0.30	.02
6	.....	.88	.07	T.	.04	.27	T.
7	.....	.....	.17	T.	T.	.....	T.
8	.....	.....	T.	.....	.....	.....	T.
9	.....	.....	.02	T.	2.24	.....	.01
10	T.	.....	.63	.....	2.00	.....	1.35
11	.....	.....	.....	0.27	.....	.....	T.
12	1.44	T.	.59	.....	.....	.04	.....
13	1.43	.....	.01	.....	.....	.....	.20
14	.02	.....	.....	T.	.....	.....	.05
15	.50	.57	.....	.....	T.	.05	.05
16	T.	.30	.....	.....	.....	.05	.02
17	.49	.....	.....	.....	.....	.76	.03
18	.16	.....	.....	.58	.88	.33	.06
19	.21	.25	.....	.01	.10	T.	.....
20	T.	.08	.85	.....	.11	T.	.04
21	1.49	.30	.....	.....	.....	.....	.31
22	.27	.38	.....	.....	.....	.....	.04
23	.....	.20	.....	.....	.05	T.	.07
24	.42	.27	.....	.....	.03	.17	T.
25	.24	.....	1.17	.....	.....	.04	.05
26	.21	.17	.18	.....	.....	.02	.04
27	.....	.....	T.	.....	.....	.02	.02
28	.....	.....	T.	.21	.26	T.	.07
29	T.	T.	.55	.15	.....	.....	.....
30	.16	.54	.11	.....	.....	.....	.03
31	.....	.05	.19	.....	.....	.....	T.
Total	7.04	4.61	5.81	1.22	7.26	2.04	2.54

SYLVAN GLEN CREEK NEAR NEW HARTFORD, N. Y.

Sylvan Glen Creek (or New Hartford Creek) is tributary to the No. 4 reservoir of the Utica waterworks. Its drainage area, which lies at an elevation of 700 to 1,500 feet above sea level, comprises an area of 1.18 square miles of woodland and pasture, with some cultivated land. The stream consists of two main branches, the larger branch flowing in a wooded valley, the smaller draining a shallow ravine. The discharge of the stream became very small in May, 1900, and it is possible that during extremely dry periods the flow may cease altogether. On June 12, 1903, a weir was established just above the mouth of the stream by the Consolidated Water Company, by whom the record has been furnished. The crest of the weir is 8 feet long, with end contractions. It has a central low-water notch 2 inches deep and 2 feet long. The gage is located 6 feet upstream from the crest of the weir.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Sylvan Glen Creek near New Hartford, N. Y., for 1903.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	2.56	7.36	12	9.54	2.94	0.99	23	2.25	2.10	11.97
2	.....	.64	4.93	13	1.43	2.05	.59	24	1.25	.82	4.93
3	.....	.37	2.93	14	1.05	1.18	.42	25	2.63	(b)	8.97
4	.....	.25	2.93	15	1.35	7.40	.25	26	2.17	7.49	.90
5	.....	9.20	1.22	16	1.29	9.18	13.28	27	.99	11.63	.38
6	.....	1.43	.61	17	4.74	13.28	6.24	28	.61	7.36	.42
7	.....	.49	.75	18	2.23	8.67	3.82	29	.52	8.80	1.79
8	.....	7.42	.40	19	1.32	10.11	3.82	30	1.72	4.44	.....
9	.....	13.07	1.62	20	1.05	7.36	.69	31	.....	13.28	.....
10	.....	8.80	.94	21	11.55	7.52	.30	Mean	2.68	5.91	3.44
11	(a)	4.93	1.54	22	3.19	2.38	14.72				

a Flow preceding June 11 insignificant. b No record.

Estimated monthly discharge of Sylvan Glen Creek near New Hartford, N. Y., for 1903.

[Drainage area, 1.18 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
June 12–30	11.55	a0	2.68	2.27	2.53
July	.....	.....	5.91	5.00	5.75
August	.....	.....	3.44	2.91	3.35

a Flow preceding June 11 insignificant; mean for 30 days 1.70 second-feet=1.44 second-feet per square mile or 1.70 inches.

New Hartford Creek discharge table for 1903, weir.

	0.00.	0.01.	0.02.	0.03.	0.04.	0.05.	0.06.	0.07.	0.08.	0.09.	0.10.
0.0	0.000	0.0148	0.0298	0.0444	0.0592	0.074	0.1008	0.1276	0.1544	0.1812	0.208
.1	.208	.2564	.3048	.3532	.4016	.45	.4976	.5452	.5928	.6404	.688
.2	.688	.8104	.9328	1.055	1.178	1.30	1.45	1.60	1.75	1.90	2.05
.3	2.05	2.22	2.39	2.56	2.73	2.90	3.084	3.268	3.452	3.637	3.821
.4	3.821	4.037	4.252	4.468	4.684	4.90	5.13	5.36	5.59	5.82	6.05
.5	6.05	6.30	6.55	6.80	7.05	7.30	7.575	7.850	8.124	8.399	8.674
.6	8.674	8.955	9.236	9.518	9.799	10.08	10.374	10.668	10.962	11.256	11.55
.7	11.55	11.848	12.146	12.444	12.742	13.04	13.35	13.661	13.971	14.282	14.592
.8	14.594	14.915	15.236	15.558	15.879	16.20	16.54	16.88	17.22	17.56	17.90
.9	17.90	18.26	18.62	18.98	19.34	19.70	20.06	20.42	20.782	21.142	21.503
1.0	21.503	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

ORISKANY CREEK NEAR ORISKANY, N. Y.

This station was established June 5, 1901, by R. E. Horton. It is located at the Wood-road bridge, 1 mile above Oriskany, N. Y. The gage is a vertical board attached to the upstream side of the right bridge abutment. It is read twice each day by Charles H. Smith. The station has been maintained only as a low-water station, and discharge measurements are made by wading a short distance below the bridge. The section at the bridge is not favorable for accurate measurement. The channel is winding both above and below the station. The right bank is high and wooded and will not overflow. The left bank is low, partly wooded, and liable to overflow. The bed of the stream is composed of sandy gravel and is shifting. There is but one channel at all stages. The bench mark is a point on the outside corner of the upstream side of the bridge seat on the right abutment. Its elevation is 13.66 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Oriskany Creek at Wood-road Bridge, near Oriskany, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 27	C. C. Covert	4.3	[a] 121
May 7	do	1.75	163
May 14	E. C. Murphy	1.725	158
May 21	W. Nunn	1.55	127
Do	do	1.55	118
July 9	H. H. Halsey	1.60	106

[a] Measurement made under ice; creek full of needle ice.

HUDSON RIVER AT MECHANICVILLE, N. Y.

A record of the flow of the Hudson River at Mechanicville has been kept by the Duncan Company since December, 1888. The records have been furnished by R. P. Bloss, the engineer of the company. The record includes two daily readings of the depth on the crest of the dam and a continuous record of the run of the water wheels in the adjoining paper mill. A record is also kept of the length and height of the flashboards, with the dates of their setting and removal. The flow over the dam has been computed by the formula $Q=3.012\ L\ H^{1.53}$, which is the Francis formula for the Merrimac dam. The length of the crest of the dam is 794 feet. The same formula has been used at all times, whether the flashboards were in place or not. The discharge at this point does not represent the total yield of the drainage basin for the reason that the Champlain Canal draws its supply from the Hudson River above Mechanicville.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Hudson River at Mechanicville, N. Y., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,122	11,857	28,898	23,345	5,158	2,271	8,484	4,395	9,003	2,568	5,665	5,555
2	7,231	11,494	20,778	21,332	4,935	2,197	8,375	.....	8,121	2,668	7,166	5,028
3	7,912	10,771	16,776	20,120	3,654	2,247	8,373	5,032	7,824	2,468	6,077	4,811
4	9,375	12,949	16,156	22,097	4,915	2,159	6,582	4,525	6,982	705	5,560	4,635
5	10,723	16,054	15,221	24,028	4,556	2,283	5,272	4,406	5,862	2,931	5,641	4,534
6	9,478	12,405	14,980	24,435	4,191	2,156	6,038	6,508	4,017	3,116	6,270	4,977
7	8,828	11,074	13,816	22,557	4,191	1,472	5,317	6,590	4,239	4,112	6,143	5,376
8	8,215	9,603	15,250	20,860	3,686	3,191	4,921	7,074	4,889	4,246	5,467	4,693
9	7,028	9,428	29,664	20,688	4,330	2,864	4,424	6,195	3,948	10,757	6,344	4,278
10	6,504	8,516	27,975	19,357	2,835	2,893	4,148	6,262	3,958	21,251	5,648	4,118
11	6,047	8,458	33,400	18,307	4,074	3,821	3,603	5,511	3,943	27,340	5,442	3,941
12	6,302	14,915	44,758	17,902	4,754	6,398	2,539	5,588	3,631	23,001	5,808	4,141
13	5,382	13,268	45,351	16,555	(b)	11,013	4,056	7,798	2,013	16,004	5,418	4,655
14	5,643	11,861	41,160	14,980	(b)	9,666	3,836	7,904	3,903	14,645	5,062	6,015
15	5,553	9,873	36,051	12,510	3,237	13,061	3,642	7,232	3,508	12,242	4,299	5,050
16	5,416	10,273	32,642	11,966	3,206	11,458	3,585	5,259	3,040	10,701	5,819	4,312
17	5,564	7,669	28,230	11,731	1,999	8,896	3,776	5,728	3,481	9,436	5,938	4,190
18	5,889	7,646	25,701	11,396	3,649	9,233	3,525	4,671	3,434	10,793	8,562	4,144
19	4,997	7,878	24,369	10,235	3,210	7,813	2,302	4,053	3,924	14,667	8,032	3,800
20	4,848	7,291	25,205	10,943	3,698	6,968	3,858	4,308	2,967	15,005	7,495	2,309
21	5,403	7,045	28,614	8,706	4,598	7,976	3,553	5,164	3,951	14,182	6,382	12,809
22	7,831	7,602	40,441	7,905	3,586	19,303	3,498	3,534	3,623	12,551	5,107	9,034
23	7,137	7,641	42,915	7,458	2,993	17,755	3,942	3,934	3,069	11,546	6,093	7,296
24	6,123	6,864	54,494	6,915	2,441	16,090	7,276	5,268	2,774	10,887	5,938	7,037
25	5,660	6,521	56,283	6,845	3,534	17,373	6,594	4,290	3,037	8,859	5,830	6,700
26	5,664	6,186	50,638	5,627	2,705	16,333	6,008	8,490	2,806	9,640	4,586	6,914
27	5,327	6,017	41,581	6,306	2,001	15,312	5,589	8,104	2,362	8,492	4,000	4,850
28	5,500	15,618	32,928	4,848	1,741	12,057	4,960	7,064	3,112	7,943	4,029	5,004
29	6,298	.....	28,102	5,614	1,955	10,286	4,436	6,565	3,310	7,319	3,801	4,706
30	12,155	.....	22,870	4,828	1,882	9,606	4,016	6,803	2,819	6,869	5,468	4,522
31	12,906	.....	23,830	.....	1,067	.....	4,226	8,898	.....	6,676	.....	4,758
Mean	7,034	9,885	30,938	14,013	3,509	8,472	4,863	5,905	4,118	10,117	5,769	5,297

[a] Flashboards at times irregular. Record approximate.

[b] No record.

Estimated monthly discharge of Hudson River at Mechanicville, N. Y., for 1903.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	12,906	4,848	7,034	1.56	1.80
February	16,054	6,017	9,885	2.19	2.28
March	56,283	13,816	30,938	6.87	7.92
April	24,435	4,828	14,013	3.11	3.47
May	5,158	1,067	3,509	.78	.90
June	19,303	1,472	8,472	1.88	2.10
July	8,484	2,302	4,863	1.08	1.25
August	8,898	3,534	5,905	1.31	1.51
September	9,003	2,013	4,118	.91	1.02
October	27,340	705	10,117	2.25	2.59
November	8,562	3,801	5,769	1.28	1.43
December	12,809	2,309	5,297	1.18	1.36
The year	56,283	705	9,160	2.03	27.63

HOOSIC RIVER AT BUSKIRK, N. Y.

Hoosic River has its headwaters in Vermont and Massachusetts on the west slope of Hoosic Mountains. Two head branches, one flowing southerly, the other northerly, along the west slope of this range, join at North Adams, Mass. The stream then flows in a northwesterly direction, entering Hudson River 3 miles north of Mechanicsville. The drainage basin above Buskirk has its greatest extent in a northerly and southerly direction; the main branches and the Little Hoosic and Walloomsac tributaries draining the valleys between parallel mountain ranges. This portion of the drainage basin is rugged and precipitous, the distribution of tributaries affording rapid concentration of the run-off from the steep rock slopes. The ridges are sparsely wooded. The general elevation of the valley at the junction of the headwaters is 1,000 feet.

At Buskirk, 27 miles downstream, following the general trend of the valley, the elevation is 360 feet above sea level. From Buskirk to the mouth of the stream the drainage basin proper of Hoosic River is relatively narrow. The only important tributary in this section is the Tomhannock, which enters Hoosic River near its mouth below all important falls. A storage reservoir is in process of erection on Tomhannock Creek for the water supply for the city of Troy.

At Johnsonville the stream is at an elevation of 300 feet at the foot

of the falls. It enters Hudson River 12 miles farther downstream, at an elevation of 80 feet above sea level. The stretch intervening between Johnsonville and the mouth of the stream contains several precipitous falls over rock, and, receiving the largest part of the tributary drainage, offers a favorable opportunity for power development, which has been largely utilized. Numerous dams affording power for textile, agricultural-implement, and other industries are scattered throughout the length of the stream from North Adams to Schaghticoke. At the foot of the lowest of the four dams at Schaghticoke the stream has an elevation of 200 feet. The succeeding 2 miles include a descent of about 80 feet, largely within an abrupt bend 1 mile in length, in which the stream returns to within one-fourth mile of the starting point. This fall is undeveloped. There are no important lakes and but one storage reservoir in the drainage basin. This is at Farnam near the head of the south branch.

The gaging station was established September 24, 1903, by E. P. Roundey. It is located at the covered wooden highway bridge at Buskirk, N. Y. A standard chain gage is attached to the guard rail near the middle of the bridge on the upstream side. The length of the chain from the end of the weight to the marker is 28.17 feet. The gage is read twice each day by Bert C. Henry. Discharge measurements are made from the single-span covered highway bridge to which the gage is attached. The initial point for soundings is the left end of the bridge. The channel is straight for 300 feet above and 800 feet below the station. The current becomes rather sluggish at extreme low water. Both banks are high, and will overflow only at extreme high water. The bed of the stream is composed of gravel, and there is but one channel at all stages. The bench mark is a square painted on the top of the upstream wing wall of the left abutment. The top of the gage pulley has an elevation of 8.30 feet above the bench mark.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Hoosic River at Buskirk, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 24	E. P. Roundey	1.80	316
October 10	do	4.69	2,893
October 12	do	3.32	1,322

Mean daily gage height, in feet, of Hoosic River at Buskirk, N. Y., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		1.78	1.96	2.19	17		2.68	2.76	3.83
2		1.80	2.16	2.03	18		3.47	3.83	3.63
3		1.80	2.11	2.13	19		3.42	3.03	3.53
4		1.65	1.86	2.19	20		3.05	2.58	3.59
5		1.88	2.29	2.11	21		2.85	2.43	5.96
6		2.25	2.73	2.01	22		2.72	2.49	3.69
7		2.02	2.36	2.11	23		2.68	2.53	3.16
8		1.98	2.21	1.93	24		2.61	2.53	2.91
9		6.35	2.23	1.96	25	1.70	2.53	2.41	2.73
10		4.95	2.19	1.99	26	1.72	2.59	2.09	2.66
11		3.62	2.16	2.11	27	1.65	2.39	2.31	2.21
12		3.40	2.16	1.86	28	1.98	2.33	2.19	3.86
13		3.05	2.13	2.19	29	1.95	2.29	2.06	3.73
14		2.82	1.99	3.03	30	1.80	2.26	2.39	4.09
15		2.65	1.93	3.23	31		2.19		4.11
16		2.65	2.16	4.01					

HUDSON RIVER AT FORT EDWARD, N. Y.

This station, which is located at the dam of the International Paper Company, was established in 1895, in connection with upper Hudson storage surveys. The dam is of framed timber on slate-rock foundation, and has but little leakage. The crest is straight, very nearly level, and 587.6 feet in length. Flashboards are usually maintained on the dam from 15 inches to 18 inches in height. A record is kept of the height of flashboards, and of the times of their setting and removal.

During 1901 the station was equipped with new metallic gages. The crest gage is attached vertically to the timber bulkhead above the left-hand end of the dam. The gages are divided to feet and inches, and readings are taken each morning by Frank Chapman.

There are 62 water wheels in the adjoining mill. These are nearly all of modern types that have been tested at the Holyoke flume. A record is kept of the daily run of each in hours, as well as of the working head, which is usually 19 feet. The discharge through the turbines is taken from diagrams expressing the flow as a function of the working head and number of wheel-hours run.

In the winter of 1896–97 a flood spillway was cut around the south end of the dam, over which the water begins to flow whenever it reaches the level of the crest of the flashboards. The profile of the spillway is very irregular and causes some uncertainty in the calculated flows during times of high water.

With the flashboards on, the flow has been computed from Francis's well-known formula for the sharp-edged weir. During the dry season

but little water passes over the dam, the entire flow being employed to drive the turbines.

During the navigation season water is diverted from Hudson River at Glens Falls feeder dam, 7 miles above Fort Edward, for the supply of Champlain Canal.

The drainage area tributary to the Hudson above Fort Edward is 0.56 of that of the same stream above the Mechanicsville gaging station. The principal intervening tributuries are the Hoosic River and Batten Kill, which have drainage areas of 716 and 428 square miles, respectively.

The record has been maintained at the station during 1903, but the computation of the discharge has been withheld temporarily.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

SCHROON RIVER AT WARRENSBURG, N. Y.

This station is located at the dam and mill of the Schroon River Pulp Company, near the mouth of the river. The record was begun in November, 1895.

The record has been maintained at the dam during 1903 in cooperation with the officials of the Schroon River Pulp Company, but the computation of the discharge has been withheld awaiting additional data to confirm the results.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

INDIAN RIVER AT INDIAN LAKE DAM, N. Y.

The observations at this station consist of a record of the stage of water in Indian Lake storage reservoir, located in the upper Hudson River drainage basin. The reported stage of water in the reservoir is shown in the accompanying table. The reservoir gates were not opened until November 25, 1903, the discharge previously having taken place through the spillway and log ways only. The reservoir was built to store water for use by the mills on Hudson River during the low-water season. The dam is of masonry and forms a lake which has a surface area of 7.87 square miles, or 5.54 per cent of the drainage area of 142 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Stage of water in Indian Lake reservoir, Hamilton County, N. Y.[a] *for 1903.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	25.00	21.17	20.25	35.42	34.33	32.75	32.75	30.46	31.29	27.92	28.50	24.58
2	24.83	21.25	20.67	35.42	34.33	32.58	32.58	30.33	31.37	27.75	28.36	24.25
3	24.75	21.21	21.00	35.42	34.38	32.33	32.58	30.17	31.42	27.62	28.25	23.88
4	24.67	21.17	21.25	35.92	34.42	32.08	32.62	30.08	31.42	27.50	28.17	23.50
5	24.58	21.13	21.33	35.92	34.50	31.83	32.67	30.33	31.42	27.42	28.00	23.16
6	24.50	21.08	21.33	35.75	34.62	31.50	32.67	30.50	31.42	27.42	27.86	22.75
7	24.33	20.92	21.33	35.67	34.75	31.17	32.71	30.58	31.33	27.38	27.75	22.38
8	24.17	20.83	21.33	35.54	34.75	30.83	32.75	30.75	31.21	27.33	27.67	22.00
9	24.04	20.75	21.67	35.42	34.75	30.46	32.75	30.86	31.08	28.08	27.58	21.70
10	23.92	20.67	22.00	35.46	34.75	30.17	32.75	31.00	30.92	29.08	27.50	21.42
11	23.75	20.67	22.50	35.42	34.75	29.83	32.67	31.21	30.75	29.63	27.42	21.12
12	23.58	20.71	23.17	35.42	34.75	30.00	33.50	31.42	30.58	30.08	27.33	20.83
13	23.42	20.75	23.83	35.42	34.71	30.00	32.25	31.58	30.42	30.17	27.25	20.54
14	23.33	20.75	24.42	35.33	34.71	30.12	32.00	31.75	30.25	30.25	27.17	20.25
15	23.21	20.75	24.83	35.25	34.67	30.21	31.75	31.83	30.12	30.33	27.08	19.92
16	23.08	20.75	25.42	35.17	34.67	30.29	31.50	31.92	30.00	30.33	27.00	19.58
17	22.96	20.75	25.83	35.68	34.67	30.38	31.29	31.96	29.88	30.25	27.00	19.25
18	22.83	20.71	26.17	35.00	34.29	30.42	31.08	31.96	29.75	30.33	27.00	18.92
19	22.67	20.67	26.83	34.92	34.25	30.46	30.88	32.00	29.71	30.50	27.00	18.58
20	22.50	20.58	27.67	34.83	33.83	30.50	30.75	32.04	29.58	30.42	26.96	18.42
21	22.33	20.50	29.08	34.75	33.79	30.83	30.58	32.08	29.46	30.33	26.92	18.16
22	22.21	20.33	30.42	34.67	33.42	31.42	30.42	31.92	29.33	30.17	26.83	17.92
23	22.08	20.17	31.67	34.58	33.42	31.83	30.33	31.67	29.21	29.96	26.79	17.66
24	22.00	20.00	33.42	36.50	33.33	32.33	30.25	31.42	29.08	29.75	26.75	17.42
25	21.83	19.83	34.83	34.42	33.29	32.50	30.29	31.17	28.92	29.62	26.71	17.16
26	21.67	19.67	35.17	34.38	33.29	32.83	30.33	31.08	28.75	29.42	26.67	17.08
27	21.54	19.58	35.33	34.33	33.25	32.96	30.42	31.08	28.58	29.25	26.33	16.92
28	21.42	19.83	35.83	34.33	33.25	33.08	30.46	31.12	28.42	29.08	25.83	16.75
29	21.29	.....	35.25	34.33	33.25	33.17	30.50	31.12	28.25	28.92	25.42	16.58
30	21.17	.....	35.17	34.33	33.08	33.00	30.54	31.17	28.08	28.75	25.00	16.42
31	21.17	.....	35.25	.....	32.92	.....	30.54	31.21	.....	28.62	.....	16.25

[a] Height of water, in feet, above bottom of sluice gates.

PASSAIC RIVER DRAINAGE BASIN.

Passaic River has its rise in Somerset and Morris counties, N. J. Above its confluence with Pompton River, its main tributary, it meanders through a flat country of Triassic red sandstones, to which in large measure must be attributed the turbidity of its waters. In contrast with the sluggish, muddy character of the Passaic, the Pompton is a rapid stream and its waters are clear. It drains parts of Sussex, Passaic, and Morris counties, and traverses for a large part of its course a country of hard, crystalline rocks and heavy forests, the general level of which is several hundred feet above that of the Passaic. At their confluence the Pompton enters with a current which carries it well toward the right bank of the Passaic, and at times of flood causes much backwater in the latter.

The flow of Passaic River is of special interest from the fact that several large cities in its drainage basin take their public water sup-

ply from it, and because of the valuable water-power privileges along its course, particularly at the city of Paterson. Several cities, including Paterson and Passaic, throw their sewage into this stream, and in the lower part of its course it becomes so polluted as to be offensive to property holders along its banks and to seriously interfere with the comfort and health of the inhabitants of several towns.

The highest recorded flood which has occurred on this drainage basin was that of October, 1903. The estimated discharge at Dundee dam was 35,800 second-feet. This flood is fully described in Water Supply Paper No. 92. The flood began at 6.30 p. m. October 8, 1903, and lasted until midnight October 18, 1903, the maximum height being reached at 9 p. m. October 10, 1903. There was a total rainfall of 11.74 inches in 36 hours.

Following is a list of the stations maintained during 1903 in the Passaic River drainage basin:

Pompton River at Two Bridges, N. J.
Pompton River at Pompton Plains, N. J.
Ramapo River near Mahwah, N. J.
Wanaque River at Wanaque, N. J.
Passaic River at Two Bridges, N. J.
Rockaway River near Boonton, N. J.
Whippany River at Monroe, N. J.
Passaic River near Chatham, N. J.
Passaic River at Millington, N. J.

POMPTON RIVER AT TWO BRIDGES (MOUNTAINVIEW), NEW JERSEY.

A station was established May 2, 1901, by George B. Hollister, on Pompton River just above its junction with Passaic River, a point 2 miles south of the railway station at Mountainview, N. J., and 2½ miles west of Littlefalls, N. J. Measurements are made from a wagon bridge. The gage is a vertical pine board, graduated to feet and tenths, spiked to the middle masonry pier on the downstream side. The bench mark is the top of the capstone of the same pier, and its elevation is 10.7 feet above the datum of the gage. The channel, which is gravelly, is straight for some distance above and below the bridge, and has a width of 165 feet between bridge abutments, broken by one pier. Both banks are about 8 feet high, and are subject to overflow only at extreme flood stages. The gage heights at this station are affected by back water from Passaic River. This station was discontinued October 3, 1903.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Pompton River at Two Bridges, New Jersey, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 6	E. P. Roundey	2.74	426
July 1	E. C. Murphy	6.00	3,867
July 7	E. P. Roundey	3.10	715

Mean daily gage height, in feet, of Pompton River at Two Bridges, New Jersey, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	5.25	3.80	6.95	4.20	1.80	0.90	6.15	2.00	3.75	1.85
2	4.80	3.65	7.60	3.85	1.65	.90	6.10	1.95	3.70	1.80
3	3.80	3.45	6.80	3.70	1.55	.80	5.15	2.00	3.50	1.65
4	4.85	3.20	5.80	3.55	1.50	.80	4.35	2.35	3.15	.....
5	4.55	3.60	4.95	3.35	1.50	.80	3.80	3.75	3.05	.....
6	4.25	3.60	4.45	3.15	1.50	.70	3.35	4.60	2.85	.....
7	3.90	3.35	4.00	3.05	1.50	.75	2.95	5.60	2.55	.....
8	3.75	3.35	4.35	3.40	1.45	1.00	2.65	5.40	2.40	.....
9	3.55	3.75	4.75	4.30	1.35	1.10	2.30	4.75	2.25	.....
10	3.45	3.95	5.00	4.60	1.25	1.20	2.15	4.55	2.20	.....
11	3.50	3.85	5.10	4.50	1.20	1.25	2.00	4.30	2.10	.....
12	4.40	4.60	4.95	4.40	1.20	1.50	1.85	4.05	2.00	.....
13	4.65	4.60	4.65	4.15	1.15	1.95	1.75	3.85	1.85	.....
14	4.60	4.40	4.25	4.30	1.10	2.65	1.65	3.55	1.80	.....
15	4.20	4.15	4.25	6.10	1.10	3.65	1.45	3.25	1.75	.....
16	3.85	4.00	3.75	7.95	1.00	4.30	1.40	3.05	2.15	.....
17	3.60	3.85	3.20	8.20	1.00	4.45	1.30	2.85	3.75	.....
18	3.35	3.65	3.00	7.20	1.00	4.10	1.30	2.65	4.00	.....
19	2.75	3.55	2.80	5.65	1.00	4.25	1.95	2.55	3.85	.....
20	2.65	3.20	2.60	4.85	.90	4.55	2.10	2.65	3.65	.....
21	2.50	2.85	2.45	4.30	.90	4.95	2.10	2.55	3.45	.....
22	2.55	2.55	2.85	3.80	.95	5.10	2.35	2.20	3.25	.....
23	2.90	2.50	5.00	3.40	1.00	5.40	2.80	2.10	3.05	.....
24	3.25	2.60	6.25	3.10	1.00	5.75	2.90	2.10	2.85	.....
25	3.70	2.70	7.15	2.80	1.00	6.00	2.80	2.00	2.80	.....
26	3.70	2.85	6.45	2.55	1.00	5.70	2.70	1.90	2.65	.....
27	3.20	3.05	5.30	2.35	1.00	4.80	2.60	1.80	2.45	.....
28	3.10	4.00	4.60	2.25	1.00	4.10	2.30	1.85	2.35	.....
29	3.40	.....	4.20	2.05	1.00	4.15	2.20	2.80	2.15	.....
30	4.00	.....	3.95	2.00	1.00	5.85	2.10	3.65	2.05	.....
31	3.90	.....	4.50	.....	.90	.....	2.00	3.80	.....	.....

POMPTON RIVER AT POMPTON PLAINS, N. J.

This station measures the combined flow of Pequannock, Wanaque, Ramapo, and Pompton rivers. It was established March 7, 1903, by the United States Weather Bureau, by which it is maintained. It is located at a 254-foot timber dam situated about half a mile east of Pompton Plains railroad station. The dam constitutes a portion of the headworks of the Morris canal feeder at Pompton Plains. A cast-iron gage is bolted vertically to the framework of the lock gates at the entrance to the canal. The gage reader for the Weather Bureau is E. M. Le Fevre, who reads the gage every morning. The main portion and crest of the dam is timber 6 inches in width. The downstream face is vertical, and 2.7 feet below the crest is an apron. The upstream side of the dam is paved. Starting at a point 6 inches below the crest of the dam, the paving is placed downward and upstream at a slope of 6 inches in 3 feet.

The rating table for this dam was constructed as follows: The Francis formula was used, modified by comparison with results of experiments made at Cornell University. The coefficients used were those derived from United States Geological Survey experiments, Cornell series 40, for a 6-inch broad-crested weir. This gives a varying coefficient for low heads up to a depth of 0.8 foot, at which height the nappe breaks clear from the horizontal face and the weir becomes practically sharp crested, giving the Francis formula, $Q=3.33\,lh^{\frac{3}{2}}$. The crest of the dam is slightly irregular, and in order to apply the weir formula to it an accurate profile was taken and the dam was divided into a number of approximately level sections. These sections comprised all elevations between certain limiting values, whether in juxtaposition or not. Each section was computed separately for all gage heights. By combining these the flow on the entire dam, which is 254.5 feet long, was obtained for each gage reading. The rating table shows the combined discharge of all sections for the same gage heights. To the flow over the dam must be added the flow through the Morris Canal feeder, records of which are maintained. All the water in times of flood passes over the dam, except in very extreme cases, as the flood of October, 1903. Bench mark No. 1 is a square chiseled on the coping of the left upstream parapet wall of the head-gates to the feeder canal. Its elevation is 11.99 feet above gage datum. Bench mark No. 2 is a square chiseled on the outside edge of the upstream parapet wall at the entrance to the feeder. Its elevation is 12.10 feet above the zero of the cast-iron gage.

On December 4, 1903, a portion of the gage broke off.

The following table shows the coefficients used in constructing the rating table:

Coefficients used in constructing rating table.

Depth.	Coefficient.	Depth.	Coefficient.
0.1	3.00	0.5	2.95
.2	2.90	.6	3.08
.3	2.65	.7	3.20
.4	2.80	.8 and all above	3.33

The following discharge measurement was made by E. P. Roundey in 1903:

July 10: Discharge, 326 second-feet.

Mean daily gage height, in feet, of Pompton River at Pompton Plains, N. J., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.0	4.4	3.9	5.7	4.1	4.7	4.0	4.3	4.2
2	.....	4.9	4.3	3.9	5.1	4.0	4.6	4.0	4.3	4.1
3	.....	4.8	4.3	3.9	4.9	4.0	4.6	4.0	4.3	4.1
4	.....	4.8	4.4	3.9	4.8	4.0	4.5	4.0	4.3	(a)
5	.....	4.8	4.3	3.9	4.6	4.8	4.5	4.0	4.3	(a)
6	.....	4.7	4.3	3.9	4.5	4.7	4.1	4.0	4.4	(a)
7	4.8	4.7	4.3	3.9	4.5	5.1	4.3	4.0	4.4	(a)
8	5.0	4.8	4.3	4.0	4.4	4.8	4.2	4.0	4.3	(a)
9	5.2	5.3	4.2	4.0	4.3	4.7	4.2	9.0	4.3	(a)
10	5.2	5.0	4.2	4.0	4.2	4.5	4.1	14.3	4.3	(a)
11	5.0	4.9	4.1	4.0	4.1	4.4	4.1	9.0	4.3	(a)
12	5.0	4.9	4.1	4.0	4.2	4.3	4.1	7.5	4.3	(a)
13	5.0	4.8	4.1	4.8	4.2	4.3	4.1	5.6	4.3	(a)
14	4.9	4.8	4.0	4.4	4.2	4.2	4.1	5.5	4.3	(a)
15	4.8	5.8	4.0	5.0	4.2	4.2	4.1	5.3	4.2	(a)
16	4.8	6.7	4.0	5.0	4.1	4.1	4.1	5.0	4.2	(a)
17	4.8	5.9	4.0	4.8	4.0	4.0	4.9	4.8	4.4	(a)
18	4.7	5.3	4.0	4.7	3.9	4.0	4.9	5.0	4.9	(a)
19	4.6	5.0	4.0	4.7	5.5	4.0	4.8	4.8	4.7	(a)
20	4.6	5.0	4.0	5.0	5.4	4.2	4.5	4.7	4.6	(a)
21	4.6	4.9	4.0	5.2	5.4	4.1	4.4	4.7	4.5	6.2
22	5.0	4.8	4.0	5.5	5.3	4.1	4.3	4.7	4.4	5.4
23	5.2	4.7	4.0	5.3	5.6	4.0	4.3	4.6	4.4	5.0
24	6.2	4.6	4.0	5.4	5.4	4.0	4.2	4.7	4.4	4.9
25	5.7	4.6	3.9	5.3	5.2	4.0	4.2	4.7	4.4	.....
26	5.3	4.6	3.9	5.2	4.8	4.1	4.1	4.6	(b)	.....
27	5.0	4.5	3.9	4.9	4.0	4.1	4.0	4.5	(b)	.....
28	5.0	4.5	3.9	4.7	4.0	4.1	4.2	4.5	(b)	.....
29	4.9	4.4	3.9	4.7	4.0	4.7	4.1	4.5	(b)	.....
30	4.8	4.4	3.9	6.0	4.1	4.8	4.0	4.4	(b)	.....
31	5.1	.....	3.9	.....	4.1	4.8	.....	4.3	(b)	.....

a Gage broken. b Frozen.

Rating table for Pompton River at Pompton Plains, N. J., for 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.65	1	4.95	1,135	6.90	4,750	9.50	11,705
3.70	3	5.00	1,205	7.00	4,980	9.60	12,005
3.75	9	5.05	1,275	7.10	5,215	9.70	12,310
3.80	18	5.10	1,345	7.20	5,455	9.80	12,620
3.85	30	5.15	1,415	7.30	5,695	9.90	12,940
3.90	50	5.20	1,490	7.40	5,935	10.00	13,260
3.95	70	5.25	1,570	7.50	6,175	10.10	13,580
4.00	94	5.30	1,650	7.60	6,415	10.20	13,900
4.05	122	5.35	1,730	7.70	6,665	10.30	14,220
4.10	154	5.40	1,810	7.80	6,925	10.40	14,540
4.15	190	5.45	1,895	7.90	7,185	10.50	14,860
4.20	232	5.50	1,980	8.00	7,450	10.60	15.185
4.25	275	5.55	2,065	8.10	7,715	10.70	15,510
4.30	325	5.60	2,150	8.20	7,980	10.80	15,850
4.35	378	5.70	2,330	8.30	8,250	10.90	16,190
4.40	435	5.80	2,520	8.40	8,520	11.00	16,530
4.45	495	5.90	2,710	8.50	8,790	11.10	16,870
4.50	555	6.00	2,900	8.60	9,060	11.20	17,220
4.55	615	6.10	3,090	8.70	9,340	11.30	17,570
4.60	675	6.20	3,290	8.80	9,630	11.40	17,920
4.65	735	6.30	3,490	8.90	9,920	11.50	18,270
4.70	800	6.40	3,690	9.00	10,210	11.60	18,620
4.75	865	6.50	3,890	9.10	10,505	11.70	18,980
4.80	930	6.60	4,090	9.20	10,805	11.80	19,340
4.85	995	6.70	4,300	9.30	11,105	11.90	19,700
4.90	1,065	6.80	4,520	9.40	11,405	12.00	20,060

Estimated monthly discharge of Pompton River at Pompton Plains, N. J., for 1903.

Date.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 7–31			1,245
April	4,300	435	1,161
May	435	50	1[illegible]
June	2,900	50	7[illegible]
July	2,330	50	77[illegible]
August	1,345	94	378
September	1,065	94	372
October	28,340	94	2,371
November 1–25			420
December 1–3 and 21–24			1,130

RAMAPO RIVER NEAR MAHWAH, N. J.

This station was established February 10, 1903, by the United States Weather Bureau, by which it is maintained. It is located at a concrete-arch highway bridge about 1 mile west of Mahwah, N. J. A standard chain gage is bolted to the hand rail on the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 20.65 feet. The gage reader for the Weather Bureau is M. F. Brooks. Discharge measurements are made from the upstream side of the concrete-arch highway bridge to which the gage is attached. The bridge has a single span of 68 feet between abutments. The initial point for soundings is the end post of the hand rail on the left bank. The channel is straight for 300 feet above and 200 feet below the bridge. The current is swift. About 200 feet below the bridge there is a rift with about 1 foot fall. The right bank is low, and during high water the lowlands on this side of the river are flooded. The left bank is high, wooded, and not liable to overflow. The bed of the stream is composed of gravel and scattered bowlders, and there is but one channel. Bench mark No. 1 is a square chiseled on the coping of the upstream parapet wall at the left bank. Its elevation is 17.72 feet above gage datum. Bench mark No. 2 is a square chiseled on the edge of the coping, 3.5 feet west of the gage pulley. Its elevation is 17.43 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Ramapo River near Mahwah, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 18	E. P. Roundy	3.98	360
July 9	do	3.18	127
Do	do	3.18	134
September 4	do	3.39	186
October 19	William Nunn	4.72	491
November 20	F. H. Tillinghast	4.10	264
December 17	do	4.10	[a] 212

[a] River frozen over—ice one-half inch thick.

Mean daily gage height, in feet, of Ramapo River near Mahwah, N. J., for 1903.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.6	4.6	3.5	2.7	5.7	2.9	4.4	3.0	4.0	3.6
2	.....	5.6	4.4	3.4	2.7	4.8	2.8	4.0	3.0	3.9	3.6
3	.....	4.9	4.4	3.4	2.7	4.3	2.7	3.7	3.0	3.9	3.6
4	.....	4.7	4.4	3.4	2.7	4.0	2.7	3.5	2.9	3.9	3.7
5	.....	4.5	4.5	3.4	2.7	3.8	4.2	3.4	2.9	3.9	3.7
6	.....	4.3	4.2	3.4	2.6	3.7	4.1	3.3	2.9	3.9	3.7
7	.....	4.2	4.1	3.3	2.6	3.6	4.7	3.2	2.9	3.9	3.7
8	.....	4.5	4.3	3.3	2.7	3.4	4.0	3.1	2.9	3.8	3.7
9	.....	5.2	5.3	3.2	2.9	3.3	3.5	3.0	9.8	3.8	3.7
10	4.3	5.1	4.8	3.2	2.8	3.2	3.4	3.0	8.6	3.7	3.9
11	4.1	4.9	4.5	3.1	2.8	3.1	3.2	3.0	7.1	3.7	3.8
12	5.1	4.8	4.4	3.1	3.1	3.1	3.3	2.9	6.6	3.7	3.8
13	4.9	4.6	4.3	3.1	4.5	3.2	3.1	2.9	6.2	3.6	3.8
14	4.6	4.3	4.1	3.0	3.7	3.2	3.0	2.9	5.7	3.6	4.7
15	4.4	4.2	6.4	3.0	4.9	3.1	2.9	2.9	5.3	3.6	4.2
16	4.3	4.1	6.9	3.0	5.4	3.0	2.9	2.9	5.1	3.6	3.9
17	4.3	4.0	6.1	2.9	4.6	3.0	2.8	5.4	4.9	4.0	[a] 3.9
18	4.0	3.9	5.4	2.9	4.2	2.9	2.8	5.0	5.1	5.2	[a] 3.9
19	3.9	3.9	5.0	2.9	4.0	3.6	3.2	4.2	4.9	4.6	[a] 3.9
20	3.9	3.8	4.7	2.8	4.2	3.3	3.2	4.0	4.7	4.3	[a] 4.0
21	3.9	3.8	4.5	2.8	4.6	3.2	3.1	3.8	4.6	4.1	[a] 6.5
22	3.7	4.8	4.3	2.8	6.0	3.1	3.0	3.6	4.5	4.0	[a] 5.8
23	3.7	5.1	4.2	2.8	5.2	3.4	2.9	3.5	4.4	4.0	5.0
24	3.7	6.4	4.1	2.7	5.6	3.2	2.9	3.4	4.6	4.0	4.7
25	3.7	6.0	3.9	2.7	5.5	3.0	2.8	3.2	4.5	3.9	4.7
26	3.7	5.3	3.9	2.7	5.0	3.0	2.9	3.1	4.4	3.8	4.6
27	3.7	4.8	3.8	2.7	4.4	2.9	2.9	3.1	4.3	3.8	4.3
28	4.7	4.6	3.7	2.7	4.1	2.8	2.9	3.2	4.3	3.7	4.1
29	.....	4.4	3.7	2.7	3.9	2.7	4.3	3.2	4.2	3.7	4.0
30	.....	4.2	3.6	2.7	6.7	3.1	4.8	3.1	4.0	3.6	[a] 4.0
31	.....	4.0	.....	2.7	.....	3.0	4.7	.....	4.0	.....	[a] 4.1

[a] River frozen over.

WANAQUE RIVER AT WANAQUE, N. J.

This station was established December 16, 1903, by F. H. Tillinghast. It is located at the highway bridge just above the Erie Railway bridge and below the factory of the Wanaque River Paper Company. The standard chain gage is situated on the upstream side of the bridge. The gage pulley is located at a point 73 feet from the right abutment. The length of the chain from the end of the weight to the marker is 17.52 feet. The gage is read twice each day by Fred A. Shippee, head carpenter of the paper company. Discharge measurements are made from the upstream side of the single-span highway bridge, which has a length between abutments of 98.5 feet. The initial point for soundings is the face of the right abutment on the upstream side. The channel is straight for 300 feet above and 200 feet below the station. The current is sluggish at low water. The right bank

is high, rocky, and wooded, while the left bank is low and without trees. All water passes under the bridge at all stages. The bed of the stream is composed of gravel, with occasional bowlders. At ordinary stages the depth of the water at the gaging section is from 2 to 5 feet. Bench mark No. 1 is a circular chisel draft on the upstream side of the right abutment. Its elevation is 13.80 feet above gage datum. Bench mark No. 2 is a square chisel draft on the upstream edge of the last stone upstream of the right abutment wing wall. Its elevation is 14.21 feet above gage datum. Bench mark No. 3 is the upper edge of lower chord on the upstream side of the bridge, 1.1 feet from the down spout. Its elevation is 13.58 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by F. H. Tillinghast in 1903:

December 15: Gage height, 2.25 feet; discharge, 187 second-feet.

Mean daily gage height, in feet, of Wanaque River at Wanaque, N. J., for 1903.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
16	2.05	20	[a] 4.88	24	2.70	28	2.06
17	2.03	21	4.00	25	2.10	29	2.10
18	1.92	22	3.65	26	2.10	30	2.10
19	2.05	23	3.08	27	2.08	31	2.06

[a] High water 11 o'clock night of 20th=7.40.

PASSAIC RIVER AT TWO BRIDGES (MOUNTAINVIEW), NEW JERSEY.

This station was established May 2, 1901, by George B. Hollister, just above the confluence of Passaic and Pompton rivers. Discharge measurements are made from a wagon bridge. The gage consists of a vertical pine board, marked in feet and tenths, spiked to the protecting timber on the upstream side of the first pier from the left bank. The bench mark is the top of the capstone of this pier, and its elevation is 13.65 feet above the datum of the gage. The channel is straight for some distance above and below the bridge and has a width of 265 feet between abutments, broken by 6 piers. The bed of the stream is composed of gravel. The right bank is about 10 feet high; the left bank is lower and liable to overflow. The gage heights at the station are affected by back water from Pompton River. This station was discontinued September, 1903.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Passaic River at Two Bridges, New Jersey, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 6	E. P. Roundey	3.80	1,093
July 1	E. C. Murphy	6.98	1,440
July 7	E. P. Roundey	4.05	1,572

Mean daily gage height, in feet, of Passaic River at Two Bridges, New Jersey, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	6.25	4.80	7.95	5.20	2.80	1.90	7.15	3.00	4.75	2.85
2	5.80	4.65	8.65	4.85	2.65	1.90	7.10	2.95	4.70	2.80
3	4.80	4.45	7.80	4.70	2.55	1.80	6.15	3.00	4.50	2.65
4	5.85	4.20	6.75	4.55	2.50	1.80	5.85	3.35	4.15	.....
5	5.55	4.60	5.95	5.25	2.50	1.80	4.80	4.75	4.05	.....
6	5.25	4.70	5.45	4.75	2.50	1.70	4.35	5.75	3.85	.....
7	4.90	4.35	5.00	4.20	2.50	1.75	3.95	6.60	3.55	.....
8	4.75	4.35	5.35	4.00	2.45	2.00	3.65	5.90	3.40	.....
9	4.55	4.75	5.75	3.80	2.35	2.10	3.30	5.75	3.25	.....
10	4.45	4.45	6.00	3.60	2.25	2.20	3.15	5.55	3.20	.....
11	4.50	4.85	6.10	3.50	2.20	2.25	3.00	5.30	3.10	.....
12	5.40	5.60	5.95	5.40	2.20	2.50	2.85	5.05	3.00	.....
13	5.65	5.60	5.65	5.15	2.15	2.60	2.75	4.85	2.85	.....
14	5.60	5.40	5.25	5.30	2.10	3.75	2.65	4.55	2.80	.....
15	5.20	5.15	5.25	7.10	2.10	4.90	2.45	4.25	2.75	.....
16	4.85	5.00	4.75	8.95	2.00	5.30	2.40	4.05	3.15	.....
17	4.60	4.85	4.20	9.20	2.00	5.45	2.30	3.85	4.75	.....
18	4.40	4.65	4.00	8.20	2.00	5.10	2.30	3.65	5.00	.....
19	3.75	4.55	3.80	6.65	2.00	5.20	2.95	3.55	4.85	.....
20	3.65	4.20	3.60	5.85	1.90	5.55	3.10	3.65	4.65	.....
21	3.50	3.85	3.45	5.30	1.90	5.95	3.10	3.55	4.45	.....
22	3.55	3.55	3.85	4.80	1.95	6.10	3.25	3.20	4.25	.....
23	3.90	3.50	4.95	4.40	2.00	6.40	3.80	3.10	4.05	.....
24	4.25	3.60	6.75	4.10	2.00	6.75	3.90	3.10	3.85	.....
25	4.65	3.70	8.40	3.80	2.00	7.00	3.80	3.00	3.80	.....
26	4.65	3.85	7.95	3.55	2.00	6.70	3.70	2.90	3.65	.....
27	4.25	4.05	6.95	3.35	2.00	5.80	3.55	2.80	3.45	.....
28	4.10	4.50	5.85	3.25	2.00	5.10	3.30	2.85	3.35	.....
29	4.35	.....	5.20	3.05	2.00	5.15	3.20	3.80	3.15	.....
30	4.55	.....	4.95	3.00	2.00	6.85	3.10	4.65	3.05	.....
31	4.95	.....	5.50	.....	1.90	.....	3.00	4.80	.....	.....

ROCKAWAY RIVER NEAR BOONTON, N. J.

This station was established March 15, 1903, by the United States Weather Bureau, by which it is maintained. It is located at Remine's bridge, about 3 miles downstream from Boonton. The gage is a vertical 2-inch by 12-inch board spiked to the face of the right abutment at its downstream end. It reads from 0 to 9 feet, and is graduated with copper staples. The gage reader for the Weather Bureau is Mrs. L. A. Van Derhoff. Discharge measurements are made from the downstream side of the single-span highway bridge, to which the gage is attached. The initial point for soundings is the face of the right abutment. The channel is straight for 300 feet above and below the station and the current is sluggish. Both banks are low, but will overflow only at very high water. The right bank is without trees; the left bank is wooded. The bed of the stream is composed of gravel with a few bowlders. The bench mark is a square chiseled on the top of the upstream end of the right abutment. Its elevation above the gage datum is 9.14 feet. There is a timber dam about 1 mile above the station.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Rockaway River near Boonton, N. J., in 1902 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
October 30	G. E. Hollister	2.10	488
1903.			
June 23	E. P. Roundy	2.20	670
July 6	do	1.62	343
September 5	do	1.10	172
October 15	do	2.80	894
October 20	Wm. Nunn	2.35	623
November 21	F. H. Tillinghast	1.52	273
December 8	do	.95	133

Mean daily gage height, in feet, of Rockaway River near Boonton, N. J., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.9	1.3	0.7	2.7	1.0	1.6	0.9	1.4	1.2
2	.....	1.8	1.2	.7	2.6	1.1	1.7	.8	1.5	1.0
3	.....	1.7	1.2	.6	2.8	.9	1.6	.8	1.1	1.0
4	.....	1.6	1.2	.7	2.8	.8	1.5	.9	1.2	1.2
5	.....	1.8	1.3	.6	2.0	1.1	1.3	.9	1.3	1.0
6	.....	1.7	1.2	.6	1.9	1.8	1.0	.8	1.5	1.0
7	.....	1.6	1.1	.5	1.8	3.2	.9	.8	1.4	1.0
8	.....	1.8	1.2	.9	1.7	3.1	.9	.7	1.3	.9
9	.....	2.5	1.1	1.0	1.8	2.3	.9	2.5	1.3	.9
10	.....	2.2	1.0	.9	1.6	1.9	.8	7.8	1.2	1.3
11	.....	2.1	1.1	.9	1.3	1.8	.9	5.7	1.4	1.2
12	.....	2.0	1.2	1.3	1.1	1.7	.8	4.5	1.3	1.5
13	.....	1.9	1.2	4.1	1.2	1.6	.7	3.8	1.1	1.1
14	.....	1.7	1.1	3.9	1.0	1.5	.9	3.7	1.0	1.9
15	1.7	3.3	.9	3.8	1.2	1.3	.8	2.8	.9	2.5
16	1.6	3.5	.9	3.7	1.1	1.2	.7	2.7	.9	2.4
17	1.6	2.8	.8	3.8	1.1	1.1	1.7	2.5	1.3	[a] 2.2
18	1.5	2.7	.7	2.9	.9	1.1	2.0	2.4	1.8	[a] 2.0
19	1.5	2.1	.7	2.8	1.7	1.2	1.9	2.5	1.9	1.9
20	1.4	1.9	.7	2.7	1.8	1.9	1.7	2.4	1.8	1.8
21	1.4	1.6	.8	2.6	1.7	1.6	1.5	2.2	1.5	2.5
22	2.1	1.8	.7	2.6	1.8	1.5	1.3	2.1	1.3	2.6
23	2.5	1.7	.6	2.9	2.1	1.5	1.2	1.9	1.2	2.8
24	3.4	1.7	.6	2.8	2.0	1.1	1.1	1.8	1.2	2.6
25	2.8	1.6	.5	2.6	1.9	.9	1.1	1.8	1.1	2.0
26	2.5	1.6	.6	2.7	1.8	1.1	1.0	1.7	1.3	2.2
27	2.2	1.5	.8	2.7	1.1	.9	1.0	1.6	1.3	2.0
28	1.9	1.4	.8	2.8	1.0	1.0	1.2	1.5	1.5	1.3
29	1.9	1.4	.7	2.8	1.1	1.1	1.1	1.5	1.3	1.5
30	1.7	1.3	.7	2.9	1.0	2.1	.9	1.4	1.4	[a] 2.0
31	2.0	.....	.7	.....	1.1	1.8	.....	1.5	.....	[a] 2.0

[a] Frozen.

Mean daily discharge, in second-feet, of Rockaway River near Boonton, N. J., for 1903.

[Drainage area, 121 square miles.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	430	230	80	815	145	325	120	260	200
2	.....	395	200	80	755	170	360	100	290	145
3	.....	360	200	60	875	120	325	100	170	145
4	.....	325	200	80	875	100	290	120	200	200
5	.....	395	230	60	470	170	230	120	230	145
6	.....	360	230	60	430	395	145	100	290	145
7	.....	325	170	40	395	1,160	120	100	260	145
8	.....	395	200	120	360	1,085	120	80	230	120
9	.....	700	170	145	395	600	120	700	230	120
10	.....	555	145	120	325	430	100	7,560	200	230
11	.....	510	170	120	230	395	120	3,880	260	200
12	.....	470	200	230	170	360	100	2,350	230	290
13	.....	430	200	1,950	200	325	80	1,660	170	170
14	.....	360	170	1,755	145	290	120	1,570	145	430
15	360	1,240	120	1,660	200	230	100	875	120	700
16	325	1,400	120	1,570	170	200	80	815	120	650
17	325	875	100	1,660	170	170	360	700	230	555
18	290	815	80	940	120	170	470	650	395	470
19	290	510	80	875	360	200	430	700	430	430
20	260	430	80	815	395	430	360	650	395	395
21	260	325	100	755	360	325	290	555	290	700
22	510	395	80	755	395	290	230	510	230	755
23	700	360	60	940	510	290	200	430	200	875
24	1,320	360	60	875	470	170	170	395	200	755
25	875	325	40	755	430	120	170	395	170	470
26	700	325	60	815	395	170	145	360	230	555
27	555	290	100	815	170	120	145	325	230	470
28	430	260	100	875	145	145	200	290	290	230
29	430	260	80	875	170	170	170	290	230	290
30	360	230	80	940	145	510	120	260	260	470
31	470	.....	80	.....	170	395	.....	290	.....	470

WHIPPANY RIVER AT MONROE, N. J.

This station was established December 23, 1903, by F. H. Tillinghast. It is located at the dam at Muir's mill, 2½ miles east of Morristown, N. J. The dam is at the outlet of Halsey Pond, near Monroe, N. J. The gage is a vertical, hard-wood rod 4 feet long, located at the head-gates of the flume. It is painted white, with black markings. It is read twice each day by Dan Kenney. The dam is used as a weir and the discharge is computed from the head on the crest. Bench mark No. 1 is a square chisel draft on the highest point of a rounded bowlder at the upstream end of the wing wall of the right abutment of the dam. Its elevation is 2.83 feet above the zero of the gage. Bench mark No. 2 is the highest point on the head of a bolt set in the base of the nearest tree to the right end of the dam. Its elevation is 2.66 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

PASSAIC RIVER NEAR CHATHAM, N. J.

This station was established February 10, 1903, by the United States Weather Bureau, by which it is maintained. It is located at the second bridge upstream from Chatham, N. J., from which place it is about 1½ miles distant. The original gage consists of a 2 by 12 inch board spiked to the upstream wing wall of the right abutment. On December 12, 1903, a standard chain gage was installed on the downstream side of the bridge; the length of the chain from the end of the weight to the marker is 14.53 feet. The gage reader for the Weather Bureau is M. A. Butler. Discharge measurements are made from the single-span steel highway bridge, to which the gage is attached. The downstream side is marked every 5 feet. The initial point for soundings is the base of the right abutment. The channel is straight for 400 feet above and below the station and the current swift. At low water the current makes a small angle with the normal to the cross section, caused by a small island just below the bridge. Two hundred feet above the bridge is an old timber dam partly washed away. Both banks are high and wooded, and are not liable to overflow. The bed of the stream is composed of gravel, with occasional bowlders. The bench mark for the old gage is the top of the first bolt on the coping of the wing wall of the right abutment on the downstream side. It is marked with black paint and has an elevation of 10.6 feet above the zero of the vertical gage. Bench mark No. 1 for the new gage is the corner of the top of the right abutment on the upstream side. Its elevation is 10.31 feet above the datum of the chain gage. Bench mark No. 2 is the upper surface of the upper chord directly over the gage pulley. Its elevation is 16.88 feet above gage datum. Both gages read 3.06 feet on December 12, 1903, at which time the chain gage was established.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Passaic River near Chatham, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 22	E. P. Roundey	3.70	368
July 6	do	2.90	137
September 5	do	3.00	148
October 15	do	5.50	1,032
November 23	F. H. Tillinghast	2.72	76
December 12	do	3.04	[a]135
December 19	do	3.60	[b]135

[a] Gaging made below regular station; ice. [b] Ice jam downstream.

Mean daily gage height, in feet, of Passaic River near Chatham, N. J., for 1903.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.3	3.4	2.5	2.1	4.2	2.6	3.4	2.6	2.7	2.5
2	.....	6.1	3.2	2.4	2.1	3.9	2.5	3.4	2.6	2.7	2.5
3	.....	5.8	3.0	2.3	2.0	3.5	2.5	3.3	2.5	2.7	2.5
4	.....	5.6	3.6	2.3	2.0	3.2	2.4	3.2	2.5	2.7	(a)
5	.....	5.0	3.5	2.3	2.0	3.0	4.5	3.0	2.4	2.8	(a)
6	.....	4.6	3.3	2.3	2.0	2.9	4.8	3.2	2.4	2.7	2.4
7	.....	4.4	3.2	2.2	2.0	2.7	4.8	3.1	2.4	2.6	2.4
8	.....	4.8	3.5	2.2	2.2	2.6	4.7	3.1	2.3	2.6	2.4
9	.....	5.0	4.5	2.2	2.5	2.5	4.7	3.0	5.0	2.6	2.3
10	4.0	5.1	4.8	2.2	2.4	2.5	4.5	3.0	7.0	2.5	3.3
11	3.5	4.9	4.3	2.1	2.4	2.5	4.2	2.9	7.2	2.5	3.2
12	3.9	4.8	3.7	2.1	3.5	2.6	4.0	2.8	7.0	2.5	3.0
13	4.0	4.3	3.6	2.1	b5.2	2.6	3.6	2.6	6.7	2.5	3.9
14	3.9	3.9	3.7	2.1	5.1	2.5	3.4	2.5	6.2	2.5	4.6
15	3.7	3.5	4.7	2.0	5.0	2.5	3.2	2.5	5.6	2.4	5.1
16	3.6	3.3	5.1	2.0	4.7	2.4	3.0	2.4	4.7	2.4	4.9
17	5.0	3.1	5.0	2.0	4.5	2.4	2.9	3.4	4.3	2.6	4.7
18	5.5	3.0	4.6	2.0	4.2	2.3	2.7	5.3	4.0	3.1	4.2
19	5.2	3.0	4.0	2.0	3.8	2.6	2.5	5.2	3.7	3.0	3.4
20	(a)	3.0	3.5	2.0	3.5	3.0	2.6	5.0	3.5	2.9	3.2
21	4.4	2.9	3.3	2.0	3.8	3.0	2.5	4.7	3.4	2.8	4.8
22	4.6	3.4	3.2	2.0	3.7	2.9	2.5	4.5	3.4	2.7	5.2
23	4.0	4.0	3.1	2.0	3.5	3.7	2.4	4.2	3.3	2.7	5.1
24	3.2	4.5	3.0	2.0	3.7	3.6	2.4	3.9	3.3	2.7	4.5
25	3.3	4.8	2.9	2.0	3.7	3.5	2.4	3.7	3.2	2.6	3.4
26	3.7	4.5	2.9	2.0	3.6	3.4	2.5	3.4	3.1	2.6	3.3
27	3.4	4.0	2.8	2.0	3.4	3.2	2.5	3.1	3.0	2.6	3.2
28	5.0	3.5	2.7	2.0	3.2	3.0	2.8	2.9	2.9	2.6	3.1
29	.....	3.3	2.6	2.1	3.1	2.9	3.2	2.8	2.9	2.5	3.0
30	.....	3.1	2.6	2.1	3.8	2.8	3.6	2.7	2.8	2.5	3.2
31	.....	3.5	.....	2.1	.....	2.6	3.6	.....	2.8	.....	3.2

a Frozen. b 6 feet at noon.

PASSAIC RIVER AT MILLINGTON, N. J.

This station was established November 25, 1903, by F. H. Tillinghast. It is located at the lower highway bridge at Millington, N. J. The standard boxed chain gage is fastened to the wooden hand rail on the downstream side of the bridge. The pulley wheel is located at a point 24 feet from the right abutment. The length of the chain from the end of the weight to the marker is 14.17 feet. It is read twice each day by Mary I. Bray. Discharge measurements are made from the downstream side of the old wooden truss bridge, to which the gage is attached. The bridge has a span of 69.7 feet. The initial point for soundings is the vertical face of the right abutment on the downstream side. The channel is straight for 600 feet above and 200 feet below the station. The current has a moderate velocity. Both banks are high, without trees, and are not subject to overflow. The bed of the stream is composed of gravel, with a few scattered bowlders, and is permanent. The section is shallow. There is but one channel at all

stages. Bench mark No. 1 is a square chisel draft on the corner of the right abutment at the downstream side. Its elevation is 11.82 feet above gage datum. Bench mark No. 2 is the top of a nail 2 feet from the ground in an ash tree 150 feet east of the bridge. Its elevation is 13.57 feet above gage datum. Bench mark No. 3 is the top of the circular iron bridge chord or tension bar directly under the pulley. Its elevation is 8.97 feet above gage datum. Bench mark No. 4 is the top of the wooden rail of the bridge at the pulley. Its elevation is 13.44 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Passaic River at Millington, N. J, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
December 10	F. H. Tillinghast	1.80	78
December 18	do	2.50	[a] 66

[a] Ice gorge below bridge.

Mean daily gage height, in feet, of Passaic River at Millington, N. J., for 1903.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1.52	12		2.02	23		3.28
2		1.48	13		2.22	24		2.55
3		1.72	14		3.28	25	1.60	2.00
4		1.50	15		3.05	26	1.65	2.00
5		1.28	16		[a] 3.02	27	1.78	2.55
6		1.88	17		[a] 3.15	28	1.70	3.25
7		1.52	18		[a] 2.68	29	1.65	[a] 2.80
8		1.45	19		[a] 2.42	30	1.58	[a] 2.60
9		1.45	20		[a] 2.90	31		[a] 2.42
10		1.82	21		[a] 4.78			
11		1.95	22		4.20			

[a] Ice.

RARITAN RIVER DRAINAGE BASIN.

Raritan River, which is the largest stream of the State of New Jersey, excepting the Delaware, rises in the highlands at the foot of Lake Hopatcong. The total area of the drainage basin is 1,105 square miles. The highlands consist mostly of trap rock and contain most of the forested portion of the basin. Only about 10 per cent of the total area is forest land; the rest of the area outside the highlands consists of trap rock or red sandstone. Of the 806 square miles of drainage area above the gaging station at Bound Brook, about 150 square miles are in the cultivated part of the highlands and on the trap ridges; the remainder is mostly on the low, level, red sandstone plain.

The valley of the Raritan is populous and highly cultivated, and a large amount of water power is utilized on its various branches. The Raritan River throughout almost its entire length is in two parts, namely, the North and South branches. The North Branch is considered a valuable source for a gravity water supply. The upper portion is at an elevation ranging from 750 to 1,100 feet. Both the North and South branches rise close to each other, separated only by a slight divide. The other important branch is Millstone River, which differs from the other branches, having its rise in sand hills and flowing northwesterly through a sandy soil. It has a large ground storage. This stream is better suited for power than for water supply, being very muddy at high stages. All three branches are united above Bound Brook, N. J.

The United States Geological Survey established gaging stations during 1903 as follows:

Raritan River at Bound Brook, N. J.
Raritan River at Finderne, N. J.
Millstone River at Millstone, N. J.
North Branch at near Far Hills, N. J.
South Branch at Stanton, N. J.

They are under the supervision of E. G. Paul, district hydrographer.

RARITAN RIVER AT BOUND BROOK, N. J.

This station was established September 12, 1903, by E. P. Roundey. It is located at the highway bridge just back of the Lehigh Valley Railway station at Bound Brook, N. J. The original gage consisted of a vertical 1¼-inch by 6-inch cypress board 12 feet long bolted to the upstream wing wall of the right abutment. It was carried away by the ice January 23, 1904. On February 2, 1904, a standard chain gage was bolted to the upstream side of the bridge 240 feet from the right abutment. The length of the chain from the end of the weight to the marker is 23.48 feet. The gage is read twice each day by Joseph K. Tantum. Discharge measurements are made from the upstream side of the 3-span highway bridge. The initial point for soundings is the face of the right abutment. The channel is straight for 500 feet above and below the station, and the current has a moderate velocity. Both banks are high, subject to overflow only at very high stages, and are without trees. The bed of the stream is composed of gravel. Bench mark No. 1 is a square chiseled on top of the upstream wing wall of the right abutment. Its elevation is 19.45 feet above gage datum. Bench mark No. 2 is the top of the rail 2 feet beyond the pulley end of the gage. Its elevation is 23.79 feet above gage datum. Bench mark No. 3 is a point on the guard rail of the bridge 225 feet from the initial point for soundings. Its elevation is 20.75 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Raritan River at Bound Brook, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 10	E. P. Roundey	1.50	570
October 18	do	3.00	2,866
December 21	F. H. Tillinghast	7.35	[a] 13,535

[a] Surface velocity coefficient used to reduce to mean = 0.90.

Mean daily gage height, in feet, of Raritan River at Bound Brook, N. J., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		1.50	1.70	1.40	17	4.50	2.40	1.50	1.90
2		1.50	1.70	1.30	18	4.00	2.85	2.05	1.80
3		1.50	1.60	1.30	19	1.70	2.35	1.60	1.90
4		1.50	1.60	1.30	20	2.25	2.15	1.50	3.80
5		1.45	1.60	1.30	21	2.30	2.10	1.50	6.40
6		1.40	1.60	1.30	22	1.90	2.00	1.50	3.00
7		1.40	1.60	1.30	23	1.80	2.00	1.50	2.30
8		1.60	1.50	1.30	24	1.70	1.95	1.50	2.20
9		7.92	1.50	1.35	25	1.55	1.90	1.50	2.10
10		12.00	1.50	2.70	26	1.55	1.75	1.45	2.05
11		6.50	1.50	1.85	27	1.50	1.60	1.40	[a] 1.90
12	1.50	5.20	1.50	1.70	28	1.75	1.60	1.40	[a] 2.00
13	1.50	3.50	1.50	3.40	29	1.50	1.70	1.40	[a] 2.00
14	1.50	2.85	1.50	3.50	30	1.50	1.70	1.40	[a] 1.80
15	1.45	2.60	1.50	2.00	31		1.70		[a] 1.80
16	3.45	2.45	1.50	2.00					

[a] Ice.

MILLSTONE RIVER AT MILLSTONE, N. J.

This station was established June 26, 1903, by E. P. Roundev. It is located at a highway bridge near the blacksmith shop in the village of Millstone, N. J. The gage is a vertical 1¼-inch by 6-inch cypress board, spiked to the left abutment of the bridge on the downstream side. It reads from 0 to 10 feet, and is graduated with galvanized-iron staples. It is read twice each day by E. H. Wyckoff, the blacksmith. Discharge measurements are made from the upstream side of the single-span highway bridge, to which the gage is attached. The bridge has a span of 93 feet and is located about 1 mile above a dam. The gage heights may be influenced by this dam and also by backwater from the Raritan River. The initial point for soundings is the face of the left abutment. The channel is straight for 500 feet above and 100 feet below the station. The current is sluggish at low water. Both banks are low, wooded, and liable to overflow. At extreme high water the right bank overflows for a considerable distance. The bed of the stream is composed of gravel. The bench

mark is a cross chiseled on the coping near the end of the downstream wing wall of the left abutment. Its elevation is 11.11 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Millstone River at Millstone, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 27	E. P. Roundey	1.20	509
September 8	do	.32	243
October 17	do	1.00	426
December 20	F. H. Tillinghast	1.58	[a] 585

[a] Conditions unfavorable.

Mean daily gage height, in feet, of Millstone River at Millstone, N. J., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.30	0.72	0.78	0.42	0.40	0.30
2		1.02	.45	.65	.42	.32	.30
3		.15	.35	.58	.40	.28	.20
4		.12	.35	.48	.40	.30	.22
5		.30	2.75	.40	.25	.40	.28
6		.30	1.12	.72	.32	.55	.28
7		.42	1.00	.48	.38	.48	.30
8		.52	.68	.40	1.35	.60	.28
9		.60	.55	.38	7.22	.45	.28
10		.35	.60	.32	(a)	.48	1.38
11		.35	.75	.38	7.10	.48	1.02
12		.50	.55	.30	4.80	.48	1.05
13		.40	.45	.25	2.52	.42	2.52
14		.38	.50	.25	1.78	.40	2.92
15		.42	.50	.25	1.42	.40	2.20
16		.30	.42	2.22	1.15	.42	1.95
17		.25	.38	3.62	1.00	.42	1.12
18		.85	.38	3.52	1.42	.75	.68
19		3.50	.40	2.25	1.10	.62	.52
20		2.35	.40	1.52	1.05	.60	2.38
21		2.05	.38	1.08	.88	.52	5.30
22		1.35	.32	.88	.75	.50	2.58
23		2.45	.32	.70	.65	.42	1.68
24		2.12	.25	.60	.65	.45	1.25
25		.88	.22	.45	.55	.48	1.12
26		.75	.25	.48	.50	.42	1.38
27		.62	.15	.55	.42	.38	1.68
28	0.10	.48	.55	.70	.38	.38	1.10
29	1.92	.48	1.62	.50	.38	.38	[b] .90
30	2.10	.45	1.15	.50	.35	.30	[b] .75
31		1.42	.85		.38		[b] .60

[a] Gage under water. [b] Ice.

RARITAN RIVER AT FINDERNE, N. J.

This station was established June 27, 1903, by E. P. Roundey. It is located at the highway bridge, one-fourth mile from the New Jersey Central Railway station at Finderne, N. J. The standard chain gage is located on the downstream side of the right-hand truss on the lower chord. The length of the chain from the end of the weight to the end of the ring is 19.56 feet. The gage is read twice each day by Nelson Jackson. Discharge measurements are made from the upstream side of the 2-span highway bridge. The initial point for soundings is the face of the right abutment. The channel is straight for 300 feet above and 800 feet below the station. The current is swift. The right bank is low, wooded, and liable to overflow. The left bank will overflow only at extreme high water. The bed of the stream is composed of gravel. The channel is broken by the center pier of the 2-span bridge. Bench mark No. 1 is a cross chiseled on the coping of the downstream wing wall of the right abutment. Its elevation is 20.11 feet above gage datum. Bench mark No. 2 is the top of the outside connection plate near the zero of the gage scale. Its elevation is 20.14 feet above gage datum. The elevation of the top of the gage pulley is 19.21 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Raritan River at Finderne, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 27	E. P. Roundey	4.55	824
September 8	do	4.25	545
October 17	do	5.05	1,415
December 20	F. H. Tillinghast	10.50	[a] 9,000
December 21	do	9.20	[b] 5,530
December 22	do	5.30	1,680

[a] Measurements made by floats. [b] Surface velocity coefficient used = 0.90.

Mean daily gage height, in feet, of Raritan River at Finderne, N. J., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.80	4.30	4.55	4.30	4.25	4.20
2	.....	4.60	4.18	4.42	4.15	4.25	4.15
3	.....	4.48	4.12	4.35	4.12	4.25	4.05
4	.....	4.50	4.25	4.30	4.15	4.25	4.05
5	.....	4.35	8.50	4.25	4.15	4.25	4.00
6	.....	4.32	5.95	4.85	3.90	4.32	4.15
7	.....	4.30	5.25	4.55	4.72	4.25	4.15
8	.....	4.15	5.35	4.22	10.68	4.25	4.15
9	.....	4.15	5.25	4.20	12.45	4.25	4.25
10	.....	4.15	4.90	4.20	15.90	4.25	4.55
11	.....	4.15	4.65	4.20	9.55	4.25	4.60
12	.....	4.15	4.50	4.20	7.25	4.20	4.15
13	.....	4.10	4.40	4.10	5.55	4.20	7.32
14	.....	4.20	4.40	4.10	5.45	4.20	5.85
15	.....	4.05	4.38	4.10	5.30	4.15	4.90
16	.....	4.05	4.25	7.35	5.20	4.05	4.85
17	.....	4.05	4.18	7.78	5.15	4.20	5.00
18	.....	3.85	4.25	6.25	5.80	4.70	4.68
19	.....	4.55	4.22	4.95	5.92	4.45	4.58
20	.....	5.45	4.20	4.92	5.90	4.20	9.00
21	.....	9.30	4.32	4.68	5.85	4.15	8.40
22	.....	5.94	4.35	4.50	5.85	4.20	4.85
23	.....	6.80	4.15	4.32	5.78	4.20	4.78
24	.....	5.05	4.15	4.25	5.60	4.20	4.70
25	.....	4.75	4.20	4.18	4.75	4.20	4.70
26	.....	4.60	4.15	4.15	4.52	4.20	4.65
27	.....	4.55	4.15	3.63	4.50	4.20	4.68
28	.....	4.55	4.40	4.10	4.50	4.20	4.78
29	6.45	4.40	5.65	4.15	4.50	4.05	4.68
30	5.50	4.50	5.00	4.12	4.50	4.00	4.65
31	.....	4.60	4.85	.....	4.50	.....	4.75

RARITAN RIVER (NORTH BRANCH) NEAR FAR HILLS, N. J.

This station was established September 9, 1903, by E. P. Roundey. It is located at the second bridge below Far Hills, N. J., on the road to Somerville, N. J., about 2 miles from Far Hills. The gage is a vertical 1¼ by 6 inch cypress board spiked to the upstream wing wall of the right abutment, reading from 0 to 10 feet. It is read twice each day by Thomas Moore. Discharge measurements are made from the single-span, wooden highway bridge on the downstream side. The initial point for soundings is the face of the right abutment at its downstream end. The channel is straight for 400 feet above and 300 feet below the bridge. A small rift occurs in the channel about 200 feet above the bridge. The current is sluggish. Both banks are low and liable to overflow. The bed of the stream is composed of gravel. There is but one channel under the bridge. The bench mark is a square chiseled on the top of the upstream wing wall of the right abutment. Its elevation is 10.38 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Raritan River near Far Hills, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 9	E. P. Roundy	1.70	74
October 20	Wm. Nunn	2.30	163

Mean daily gage height, in feet, of North Branch Raritan River near Far Hills, N. J., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		1.58	1.82	a 1.80	17	3.17	2.35	2.00	a 2.50
2		1.62	1.80	a 1.80	18	2.29	2.55	1.95	a 2.50
3		1.62	1.80	a 1.80	19	1.85	2.40	1.85	a 2.50
4		1.55	1.80	a 1.75	20	1.95	2.34	1.78	4.30
5		1.55	1.80	a 1.75	21	1.90	2.22	1.70	2.85
6		1.56	1.80	a 1.75	22	1.82	2.18	1.70	2.80
7		1.48	1.80	a 1.78	23	1.75	2.12	1.70	2.45
8		1.80	1.80	a 1.90	24	1.75	2.15	1.70	2.05
9	1.80	b 6.50	1.75	a 1.90	25	1.68	2.00	1.70	2.00
10	1.70	3.25	1.75	a 2.20	26	1.70	1.90	1.70	2.00
11	1.70	3.25	1.70	a 1.90	27	1.71	1.90	1.80	a 2.60
12	1.62	3.10	1.70	a 1.90	28	1.86	1.85	1.80	a 2.90
13	1.61	3.05	1.70	a 3.85	29	1.70	1.90	1.80	a 2.50
14	1.60	2.90	1.70	a 3.35	30	1.56	1.90	a 1.80	a 2.50
15	1.50	2.71	1.70	a 2.00	31		1.90		a 2.50
16	3.19	2.48	1.70	a 2.00					

a Ice. b High mark, 8 feet.

RARITAN RIVER (SOUTH BRANCH) AT STANTON, N. J.

This station was established July 2, 1903, by E. P. Roundey. It is located at the highway bridge about 500 feet from the Lehigh Valley Railroad station at Stanton, N. J. The standard chain gage is located on the lower chord of the bridge on the downstream side. The length of the chain from the end of the weight to the marker is 14.63 feet. It is read twice each day by William Wilson, the station agent. Discharge measurements are made from the downstream side of the single-span highway bridge. The initial point for soundings is the face of the right abutment. The channel is straight for 800 feet above and 400 feet below the station. The current is swift. Both banks are low and liable to overflow. The bed of the stream is composed of gravel, and there is but one channel under the bridge. The bench mark is a square chiseled on the coping of the left abutment 1½ feet from the downstream end.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of South Branch Raritan River at Stanton, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 30	E. P. Roundey	3.65	503
July 2	do	3.24	301
September 7	do	2.66	159
October 21	Wm. Nunn	3.40	394
December 21	F. H. Tillinghast	4.39	840

Mean daily gage height, in feet, of South Branch Raritan River at Stanton, N. J., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.88	3.02	2.51	3.01	2.74	17	2.78	2.91	3.60	3.82	3.05	[b]4.52
2	3.28	2.79	2.95	2.54	2.95	2.78	18	3.95	2.90	3.46	3.92	3.10	[b]4.40
3	3.18	2.79	2.73	2.50	2.92	3.28	19	3.37	2.99	3.20	3.54	2.98	[b]4.38
4	3.11	2.95	2.72	2.54	2.91	2.95	20	5.12	2.96	2.96	3.48	2.90	[b]6.45
5	3.04	3.10	2.70	2.54	2.95	2.74	21	4.50	2.86	2.74	3.38	2.84	4.88
6	3.10	4.22	2.71	2.54	2.98	2.75	22	3.34	2.77	2.70	3.36	2.78	3.78
7	2.95	4.65	2.66	2.50	2.88	2.98	23	4.28	2.79	2.67	3.34	2.76	3.25
8	2.84	3.55	2.61	3.48	2.82	2.61	24	3.50	2.79	2.64	3.28	2.78	3.22
9	2.82	3.36	2.61	[a]8.25	2.84	2.80	25	3.22	2.72	2.58	3.26	2.80	3.25
10	2.82	3.31	2.65	8.15	2.81	3.10	26	3.08	2.70	2.48	3.22	2.72	3.22
11	2.91	3.25	2.68	5.30	2.81	2.81	27	3.08	2.69	2.58	3.16	2.65	3.20
12	2.96	3.20	2.66	4.70	2.75	2.91	28	2.91	2.98	2.62	3.22	2.65	3.35
13	2.92	3.01	2.61	4.26	2.75	4.45	29	2.95	3.75	2.58	3.08	2.70	3.51
14	2.88	3.08	2.58	4.08	2.71	4.08	30	3.25	3.32	2.52	3.10	2.74	4.01
15	2.72	2.98	2.51	3.85	2.70	3.35	31	3.15	3.18	.....	3.03	.....	4.51
16	2.80	2.94	3.20	3.81	2.74	[b]4.30							

[a] High water, 10.5. [b] Ice.

DELAWARE RIVER DRAINAGE BASIN.

Delaware River rises on the slope of Mine Mountain, near the southwestern line of Schoharie County, flows southwesterly across central Delaware County to Deposit, where it is joined by Oquaga Creek, a large tributary draining eastern Broome County. The upper drainage area is relatively long and narrow, with numerous short lateral tributaries. It is rugged and to a considerable extent wooded. There are low water-power dams near Hamden and Delhi. At Deposit the stream turns abruptly to the southeast, forming the boundary line between New York and Pennsylvania, until Port Jervis is reached. Here it encounters the foot of the Shawangunk Range, and its direction of flow is again turned to the southwest. Below Port Jervis the

Delaware forms the division between Pennsylvania and New Jersey, and ultimately empties into Delaware Bay below Philadelphia. Above Hancock the main stream is known as the West Branch of Delaware River, to distinguish it from the smaller East or Pepacton Branch.

The West Branch of the Delaware is sometimes called the Mohawk. It should not be confused with Mohawk River, a tributary of Hudson River. The East Branch of the Delaware flows parallel to the West Branch across southern Delaware County, but its drainage area is broader and its tributaries longer and more branching than those of the West Branch. Many of the tributaries head in small lakes and ponds.

From Hancock to Port Jervis, a distance by river of 76 miles, the Delaware flows in a broad, shallow channel, with numerous slight rifts and a relatively rapid current. Several large tributaries enter in this section of the stream, notably Mongaup and Callicoon creeks and Navesink River from the New York side, and the Lackawaxen River from Pennsylvania.

The drainage area of Delaware River above Port Jervis lies about four-fifths in New York and one-fifth in Pennsylvania.

Navesink River rises in southwestern Ulster County, two branches uniting to form the main stream near Sullivan County line. The stream then flows southerly, crossing eastern Sullivan County, and enters Delaware River at Port Jervis. Its fall is rapid and often precipitous, and its drainage basin contains numerous small lakes.

This stream has been suggested as a possible source of water supply for New York, the proposed point of diversion being "The Kitchen," at Quarryville, at an elevation of 850 feet above tide. The drainage area at this point is 200 square miles and at the mouth of the stream is 346 square miles.

Stations were maintained in this basin during 1903 by the United States Geological Survey as follows:

West Branch of Delaware at Hancock, N. Y.
East Branch of Delaware at Hancock, N. Y.
Delaware River at Lambertville, N. J.
Navesink River at Port Jervis, N. Y.
Navesink River at Goddefroy, N. Y.
Lehigh River at South Bethlehem, Pa.
Musconetcong River at Asbury, N. J.
Musconetcong River near Bloomsbury, N. J.

Aside from these stations, measurements have been made for several years by John E. Codman, hydrographer of the water department of the city of Philadelphia. The stations maintained by Mr. Codman are located on the following streams, all in the vicinity of Philadelphia: Perkiomen, Tohickon, and Neshaminy creeks, and Schuylkill River.

SCHUYLKILL RIVER NEAR PHILADELPHIA, PA.

This river receives the drainage of the portion of southeastern Pennsylvania lying between the Lehigh River on the north and the Susquehanna River on the south. It flows in a general southeasterly course, emptying into Delaware River, the city of Philadelphia being located at the junction of these streams. Records of the height of the river at Fairmount pool have been kept for many years, but not in such form as to be useful in computing daily discharges. In 1898, however, careful estimates were prepared by Mr. Codman, the results being given in the Twentieth Annual Report, Part IV, page 97.

The figures for daily discharge in the following table represent the total flow of the stream, the amount wasted over the flashboards at Fairmount dam, the pumpage from the river, the leakage, and also the quantity used for power at Fairmount.

The following figures for 1903 were furnished by Mr. Codman:

Mean daily discharge, in second-feet, of Schuylkill River at Philadelphia, Pa., for 1903.

[Drainage area, 1,915 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,278	4,629	29,874	5,440	2,693	1,445	4,062	5,195	2,880	1,346	1,260	1,416
2	4,520	4,229	16,114	4,560	2,582	1,445	2,708	4,458	2,208	1,346	1,260	1,416
3	18,230	4,011	10,374	4,220	2,386	1,445	2,242	2,191	1,604	1,346	1,260	1,416
4	12,570	12,789	8,314	5,662	2,242	1,445	4,922	1,498	1,274	1,346	1,260	1,416
5	9,800	14,229	7,044	3,810	2,242	1,445	2,512	2,053	1,274	1,346	1,260	1,416
6	8,340	9,289	6,244	4,320	2,242	1,445	1,728	2,923	1,604	1,346	1,260	1,416
7	7,200	7,809	5,814	3,928	2,112	1,445	1,362	2,411	1,182	1,346	1,260	1,416
8	6,030	7,289	5,394	6,580	2,312	1,445	1,362	2,411	1,182	1,656	1,260	1,416
9	5,060	6,889	6,784	13,920	1,816	1,445	1,362	1,751	1,182	17,806	1,260	1,416
10	4,410	6,059	7,304	10,660	1,816	1,445	1,362	1,385	1,182	29,986	1,260	1,416
11	3,683	5,181	6,914	8,100	1,766	1,445	1,362	1,385	1,182	16,056	1,260	1,416
12	4,852	7,959	6,544	6,980	1,506	7,725	1,362	1,385	1,182	11,166	1,260	1,416
13	7,890	8,559	5,582	6,850	1,506	3,239	1,362	1,385	1,182	7,476	1,260	2,762
14	2,630	6,889	5,144	10,180	1,506	2,113	1,362	1,385	1,182	5,156	1,260	4,976
15	3,308	6,639	4,494	19,520	1,506	1,987	1,362	1,385	1,182	4,256	1,260	2,603
16	4,010	8,559	4,062	15,3 0	1,506	1,705	1,362	1,385	1,182	3,419	1,260	1,508
17	4,310	8,849	4,062	11,340	1,506	1,445	1,362	1,385	1,182	3,044	1,260	1,416
18	4,310	6,789	3,984	8,540	1,506	1,445	3,846	1,385	1,442	3,419	1,626	1,416
19	3,498	5,279	3,766	7,110	1,506	1,445	11,182	1,385	1,442	3,746	1,738	1,416
20	2,630	4,954	3,657	6,480	1,506	1,924	5,042	1,385	1,182	2,692	1,260	7,996
21	16,480	4,739	3,657	5,818	1,506	4,355	5,782	1,385	1,182	2,372	1,260	14,656
22	10,120	4,307	5,264	5,080	1,506	3,923	3,052	1,385	1,182	1,952	1,260	5,714
23	5,908	4,307	14,644	4,320	1,506	2,471	2,098	1,385	1,182	1,952	1,260	3,489
24	3,683	4,307	24,364	4,220	1,506	3,923	1,580	1,385	1,182	1,952	1,260	3,489
25	2,797	4,307	19,774	4,220	1,506	2,143	1,420	1,385	1,182	1,712	1,260	2,954
26	2,564	4,307	11,584	4,070	1,506	2,181	1,362	1,385	1,182	1,438	1,260	3,100
27	2,490	4,307	8,314	3,920	1,506	1,663	1,362	1,385	1,182	1,438	1,260	1,634
28	7,740	25,019	6,644	3,408	1,506	1,477	1,362	1,385	1,182	1,438	1,260	1,516
29	8,910	.....	5,582	2,955	1,506	1,621	1,362	4,945	1,182	1,438	1,260	1,416
30	6,810	.....	5,394	1,866	1,506	2,714	1,728	3,567	1,182	1,346	1,260	1,416
31	6,030	.....	6,004	.....	1,506	.....	9,552	3,075	.....	1,346	.....	1,416

PERKIOMEN CREEK AT FREDERICK, PA.

Perkiomen Creek drains an area lying northwest of the city of Philadelphia. It flows in a southerly direction, emptying into Schuylkill River about 7 miles above Norristown and about 18 miles above Philadelphia. The point of measurement of discharge is located at Frederick about 12 miles above the mouth, and is also above two large tributaries known as West Swamp Creek and Northeast Branch of Perkiomen. Both of these tributaries have been measured—the first at Zieglerville, and the second near Schwenkville. The drainage area of the Perkiomen above the point of measurement is given by Rudolph Hering as 152 square miles, of which 111 are cultivated and improved and 41 untillable and wooded. Measurements of this creek were begun on August 20, 1884. Water-Supply Paper No. 35 contains tables of the daily discharge for the entire period from 1884 to 1899, inclusive. The records of daily discharge for 1903, as furnished by John E. Codman, hydrographer of the water department of Philadelphia, are given in the following table:

Mean daily discharge, in second-feet, of Perkiomen Creek at Frederick, Pa., for 1903.

[Drainage area, 152 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	230	301	1,103	351	119	47	125	60	192	69	60	55
2	259	302	496	254	113	53	90	41	141	66	61	53
3	3,840	293	419	213	107	53	76	43	115	66	66	57
4	911	2,520	341	468	126	50	143	69	88	60	73	57
5	541	999	318	423	128	45	118	204	77	46	77	60
6	493	348	290	270	111	45	60	131	69	38	81	60
7	367	312	255	415	111	60	55	129	59	36	79	60
8	322	351	391	1,470	102	100	58	128	60	85	59	60
9	249	362	568	1,876	96	99	46	80	60	4,236	54	60
10	265	218	468	514	97	77	45	67	64	3,142	67	67
11	245	474	489	389	88	1,147	48	68	69	770	65	75
12	381	956	406	450	80	1,668	46	63	64	467	58	75
13	290	437	301	463	83	296	49	55	54	281	57	611
14	300	351	275	1,737	82	198	54	62	49	219	57	491
15	198	386	242	2,126	72	235	58	69	51	177	58	224
16	198	803	210	911	73	172	52	60	53	138	75	141
17	232	481	196	581	75	138	43	54	48	131	139	114
18	221	404	186	427	67	128	2,055	54	300	215	349	107
19	188	327	171	336	66	99	862	51	100	188	109	62
20	166	285	168	296	67	202	1,011	51	59	163	104	2,813
21	2,017	282	199	256	65	825	955	51	49	125	90	1,196
22	702	233	520	217	54	295	329	47	52	119	73	397
23	328	207	2,778	203	44	378	214	40	56	133	79	209
24	219	208	1,278	195	52	512	145	40	60	96	95	168
25	222	208	544	183	46	278	113	48	49	62	84	163
26	203	208	380	173	38	199	36	50	40	67	66	140
27	195	481	342	165	38	156	74	47	33	81	59	119
28	1,295	6,181	305	155	45	109	62	473	29	70	59	124
29	700	.....	249	142	48	168	52	976	41	61	55	92
30	856	.....	252	128	46	200	102	131	58	62	57	71
31	444	.....	555	.....	43	.....	614	233	.....	65	.....	68

NESHAMINY CREEK BELOW THE FORKS, PENNSYLVANIA.

The drainage basin of Neshaminy Creek is immediately south of that of Tohickon Creek and of a portion of that of Perkiomen Creek. The stream flows in a general southeasterly and southerly course, entering Delaware River at a point about 12 miles above Philadelphia. The point of measurement is at the forks of Big and Little Neshaminy creeks. The drainage area at this point is 139.3 square miles, of which 128.2 are cultivated and improved and 11.1 miles untillable and wooded. The daily discharges from 1884 to 1900 are given in Water-Supply Paper No. 47, pages 90 to 98. The following table of daily discharge for 1903 was furnished by Mr. Codman:

Mean daily discharge, in second-feet, of Neshaminy Creek below the forks, for 1903.

[Drainage area, 139.3 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	183	188	950	326	110	25	68	73	97	25	63	31
2	192	164	433	235	107	18	40	32	79	24	56	31
3	3,147	189	339	213	98	21	66	22	63	23	54	31
4	637	2,946	287	526	112	13	76	26	47	20	59	31
5	409	917	264	402	115	17	50	87	50	20	68	34
6	424	223	235	221	105	19	34	90	297	20	76	38
7	340	72	227	333	99	20	31	98	90	20	68	41
8	207	72	393	1,535	94	29	26	86	54	1,061	52	41
9	207	132	868	1,011	87	37	19	37	48	6,985	50	71
10	207	167	541	536	64	32	15	36	44	2,742	48	133
11	435	319	506	348	48	108	19	34	41	1,338	44	159
12	435	1,003	439	339	48	88	18	31	38	553	41	144
13	185	427	505	326	46	69	15	34	28	362	41	1,655
14	144	371	267	2,952	43	47	15	62	24	261	42	448
15	107	410	235	2,208	41	41	14	99	26	192	41	357
16	88	657	200	1,003	41	41	12	52	202	166	47	644
17	88	607	179	472	36	36	11	36	240	188	63	546
18	88	435	165	405	33	28	975	31	129	196	121	388
19	80	339	153	330	36	26	737	26	78	158	79	273
20	80	287	146	290	33	56	111	21	47	132	53	2,704
21	2,098	242	167	260	31	140	60	19	41	122	47	1,171
22	457	213	1,005	235	31	94	47	18	36	109	41	203
23	154	213	2,128	213	31	68	322	16	32	105	40	154
24	120	213	839	193	28	121	90	16	32	92	40	144
25	105	213	442	179	26	90	45	18	29	85	41	144
26	97	213	320	167	24	47	34	16	26	81	41	154
27	80	352	264	154	24	36	27	15	27	77	41	176
28	1,698	4,984	225	129	23	31	22	114	80	73	40	188
29	446	.....	198	110	23	164	22	454	52	69	30	165
30	448	.....	397	105	33	173	38	184	29	68	27	138
31	229	.....	982	.....	36	.....	366	115	.....	68	.....	138

DELAWARE RIVER AT LAMBERTVILLE, N. J.

This river rises in Delaware County, N. Y., flows in a southerly direction, forming the boundary between the States of Pennsylvania

and New Jersey, and empties into Delaware Bay. Measurements of flow were made during the latter half of June, 1891, by Prof. Dwight Porter and students at the Delaware Watergap, Pa. The results show a flow of from 2,000 to 2,200 second-feet. This was said to be the lowest June stage for five years. Measurements were made during the drought of 1895 by Prof. L. M. Haupt at Point Pleasant, Pa., near the intake of the Delaware and Raritan Canal feeder. The discharge above the bridge was 1,657 second-feet, and below the bridge 1,328 second-feet. Delaware River was measured by E. G. Paul. June 4, 1899, at Martins Creek, Pa., 7 miles above the mouth of Lehigh River, and a discharge of 2,724 second-feet was found. Systematic measurements of river height were begun on July 23, 1897, at the covered toll bridge at Lambertville, N. J., a town on the Belvidere division of the Pennsylvania Railroad, 16 miles above Trenton. The gage, established by E. G. Paul, consisted of a stamped-link brass chain with a 6-pound sash weight attached. The chain passed over a pulley and the index was referred to a scale painted on a horizontal board 32 feet long, fastened to the studding and inclosed in a wooden cover. The index of the gage chain was marked by a copper rivet, 28.85 feet from the end of the weight; the gage read 2 feet when the water was at zero on a gage on the first bridge pier. Measurements were made from the windows of this covered bridge. The initial point for soundings was on the left bank. The channel above and below is nearly straight, the water being sluggish for a short space on the left side. The right bank is high and the bed of the stream is of gravel and sand. The observer was Charles H. Naylor, collector of bridge tolls, Lambertville, N. J.

The bench mark is a copper bolt set in the sill of the extreme south door of the east side of the Pennsylvania Railroad depot, put in by the Pennsylvania Railroad Company on their line of levels, No. 9, Sandy Hook mean tide, 72.69 feet. Its elevation is 27.43 feet above gage datum. The bridge at which this station was located was washed away by the flood of October 10–11, 1903, but gage heights have been taken from a temporary gage on one of the piers.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Delaware River at Lambertville, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 27	John C. Hoyt	6.00	22,354
August 3	do	4.18	7,305

Mean daily gage height, in feet, of Delaware River at Lambertville, N. J., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.45	7.65	[a]13.58	6.60	4.20	3.00	5.70	4.60	6.90	3.50	4.65	4.40
2	5.25	6.45	12.90	6.40	4.05	2.95	5.55	4.25	6.15	3.50	4.65	4.35
3	6.65	6.25	9.15	5.95	3.95	2.85	5.40	4.05	5.60	3.50	4.55	4.55
4	6.75	7.44	7.85	5.85	3.90	2.85	4.85	4.00	5.25	3.25	4.50	4.30
5	6.65	8.40	7.20	5.95	4.00	2.70	4.75	4.85	4.95	3.40	4.50	4.45
6	6.35	7.65	6.80	5.70	3.95	2.70	4.50	5.80	4.75	3.30	4.50	4.40
7	5.95	7.20	6.60	5.50	3.85	2.85	4.35	6.50	4.50	3.30	4.45	4.25
8	5.50	6.60	6.70	6.40	3.75	3.25	4.15	6.60	4.35	3.70	4.60	4.30
9	5.20	6.30	7.30	7.45	3.65	3.80	4.10	5.85	4.25	9.40	4.50	4.40
10	4.85	5.80	9.10	8.00	3.60	3.60	3.95	5.45	4.20	20.20	4.40	4.45
11	(b)	5.50	8.60	7.35	3.60	3.65	3.85	5.10	4.15	[c]20.70	4.30	4.30
12	(b)	6.40	9.90	6.90	3.55	5.70	4.00	4.90	4.10	12.70	4.30	4.25
13	(b)	7.30	9.10	6.60	3.45	9.55	3.90	4.75	4.10	9.85	4.20	4.80
14	(b)	7.50	7.70	7.13	3.40	9.35	3.80	4.60	4.05	7.30	4.25	5.25
15	(b)	6.85	7.25	7.80	3.40	7.60	3.75	4.30	3.95	5.55	4.20	(b)
16	(b)	6.50	6.80	7.45	3.35	7.10	3.65	4.25	4.25	4.85	4.20	(b)
17	(b)	6.30	6.45	7.05	3.30	6.35	3.60	4.20	3.95	4.45	4.20	(b)
18	4.30	5.65	6.15	6.45	3.35	5.90	3.85	4.10	4.50	4.40	5.60	(b)
19	4.70	(b)	5.85	5.90	3.30	5.50	4.80	4.05	4.65	4.40	7.35	(b)
20	4.40	(b)	5.65	5.65	3.30	5.45	4.85	4.05	4.50	4.45	6.50	3.70
21	5.40	(b)	5.50	5.40	3.30	5.80	5.55	4.20	4.35	4.05	5.80	5.55
22	5.85	(a)	6.15	5.25	3.30	6.65	5.05	4.10	4.10	3.85	5.45	6.25
23	5.35	4.80	7.90	5.05	3.30	6.80	5.05	4.10	4.00	5.70	5.25	4.95
24	5.50	4.90	[d]12.73	4.85	3.30	6.60	5.15	4.00	3.85	5.65	5.05	4.15
25	5.10	4.90	[d]12.40	4.80	3.25	6.70	5.05	3.85	3.65	5.50	5.00	3.85
26	4.70	4.70	9.55	4.70	3.10	6.30	4.60	3.75	3.60	5.35	4.85	3.70
27	4.65	4.70	8.10	4.55	3.20	5.95	4.30	3.75	3.55	5.15	4.55	3.45
28	4.65	8.12	7.25	4.45	3.00	5.55	4.10	4.25	3.55	5.10	4.40	3.00
29	5.65	.....	6.65	4.35	3.10	5.45	3.90	4.95	3.50	5.00	4.70	(b)
30	5.75	.....	6.15	4.20	3.10	5.60	3.90	7.56	3.50	4.90	4.50	(b)
31	8.15	.....	6.45	.....	3.10	.....	4.60	7.75	.....	4.80	.....	(b)

[a] Highest record 15.10 at 8.40 p. m.
[b] Frozen at gage.
[c] Highest record 24.5 at 3 a. m.
[d] Highest record 13.8 at 10.20 p. m.

TOHICKON CREEK AT POINT PLEASANT, PA.

Tohickon Creek drains an area of 102 square miles in Bucks County, north of Philadelphia. It flows in an easterly course, entering Delaware River about 8 miles above Lambertville, N. J. In a statement by Rudolph Hering, printed in the report of the Philadelphia water department for 1885, page 350, is given a classification of the drainage area of Tohickon Creek, from which it appears that 76 square miles is cultivated and improved and 26 square miles untillable and wooded. Measurements of the discharge of the creek are made near its mouth at Point Pleasant. Rain gages are located within the drainage basin at Quakertown, also at a point about 3 miles north of Bedminster, and near Point Pleasant.

Tables of daily discharge in second-feet, for the years 1883 to 1899, inclusive, are published in Water-Supply Paper No. 47, page 81.

Daily records of gage height were not kept during 1900. The following figures of discharge for 1903 were furnished by Mr. Codman:

Mean daily discharge, in second-feet, of Tohickon Creek at Point Pleasant, Pa., for 1903.

[Drainage area, 102.2 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	170	223	1,594	240	27	4	80	44	84	11	22	23
2	323	162	526	115	28	5	72	23	62	11	21	25
3	1,889	92	181	83	21	5	71	20	49	9	21	56
4	993	1,940	138	440	22	4	48	31	58	10	22	64
5	504	1,186	116	402	36	3	66	136	340	5	24	35
6	308	265	105	135	36	3	32	115	224	9	28	30
7	172	230	87	152	32	3	24	112	73	7	27	50
8	135	220	341	1,395	29	16	15	73	49	619	21	55
9	120	223	670	1,253	24	34	14	52	40	4,968	22	39
10	131	143	465	333	16	70	11	43	35	2,402	20	39
11	598	229	419	386	21	290	11	41	34	203	21	44
12	610	920	345	450	24	640	10	36	32	404	24	60
13	144	356	157	266	17	345	12	26	21	240	23	649
14	131	250	114	1,571	15	108	13	29	20	107	23	756
15	119	185	92	2,260	15	76	10	28	11	76	18	313
16	107	456	86	908	12	59	8	15	28	59	16	129
17	107	531	78	392	7	40	5	24	131	60	41	95
18	107	203	67	184	8	33	302	16	142	79	243	100
19	107	194	64	115	12	31	1,132	21	61	79	141	124
20	131	134	61	84	11	40	1,115	18	42	62	63	1,435
21	1,078	112	88	72	9	637	1,766	10	30	46	42	1,857
22	812	106	659	59	7	259	547	10	29	38	33	383
23	240	100	2,204	53	8	181	320	8	30	38	32	178
24	120	97	1,774	50	6	468	117	8	23	43	29	125
25	85	87	480	46	5	214	59	10	14	42	27	97
26	72	87	172	45	6	105	43	7	11	33	31	97
27	68	171	102	47	5	65	29	5	10	30	31	97
28	645	3,498	79	41	4	46	20	171	8	31	27	97
29	808	.....	73	32	4	304	22	897	9	29	20	97
30	773	.....	183	28	6	163	281	303	10	27	20	92
31	328	.....	695	.....	5	.....	168	149	.....	25	.....	87

MUSCONETCONG RIVER AT ASBURY, N. J.

This station was established July 4, 1903, by E. P. Roundey. It is located at the graphite milldam at Asbury, N. J. The gage is a vertical 1¼ by 6 inch cypress board, reading from zero to 8 feet and spiked to the timber frame which holds the gates to the flume. The discharge is computed from the head on the crests of the two spillways, using coefficients derived from experiments made at Cornell University. Levels of the crest have been taken and their profile plotted. There are two sections of the dam. The right section is 42 feet in length, has a vertical downstream face, and a slope of 4:1 on the upstream face. The coefficient used for this section was derived from the general curve for varying upstream slopes deduced from the recomputed United States deep waterway experiments and is 3.48. The left sec-

tion has a length of 83.75 feet and has the same upstream slope as the right section. On the downstream face is an apron with a slope of 2 horizontal to 1 vertical. The coefficient used for this section was 3.66. The increase due to apron siphonage has been estimated by comparison of Freeman's Cornell series to model B with United States deep waterway experiments.

A rating table has been constructed by computing the discharge separately for the different sections of the dam and then combining these discharges to form a single table. To the flow over the dam must be added the amount of water that passes through the wheels, a record of which has been maintained. The observer is Lewis Miller. Records at this station are made only at flood stages, when the record at the near-by meter station might be defective, owing to overflow. The bench mark is a square chiseled on the upstream corner of the right abutment of the right section of the dam. Its elevation is 7.94 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Rating table for Musconetcong River at Asbury, N. J., for 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.50	18	1.50	488	2.80	1,635	4.80	4,090
.55	32	1.55	523	2.90	1,741	4.90	4,225
.60	47	1.60	559	3.00	1,847	5.00	4,365
.65	62	1.65	595	3.10	1,960	5.10	4,510
.70	78	1.70	631	3.20	2,073	5.20	4,665
.75	95	1.75	668	3.30	2,176	5.30	4,820
.80	113	1.80	708	3.40	2,294	5.40	4,975
.85	132	1.85	749	3.50	2,412	5.50	5,130
.90	152	1.90	791	3.60	2,532	5.60	5,285
.95	172	1.95	834	3.70	2,652	5.70	5,440
1.00	193	2.00	877	3.80	2,774	5.80	5,595
1.05	215	2.05	920	3.90	2,901	5.90	5,755
1.10	241	2.10	963	4.00	3,028	6.00	5,915
1.15	268	2.15	1,006	4.10	3,157	6.10	6,075
1.20	296	2.20	1,049	4.20	3,286	6.20	6,235
1.25	325	2.30	1,137	4.30	3,415	6.30	6,405
1.30	355	2.40	1,228	4.40	3,550	6.40	6,570
1.35	387	2.50	1,322	4.50	3,685	6.50	6,730
1.40	419	2.60	1,423	4.60	3,820		
1.45	453	2.70	1,529	4.70	3,955		

To this must be added flow through the mill wheels.

MUSCONETCONG RIVER NEAR BLOOMSBURY, N. J.

This station was established July 4, 1903, by E. P. Roundey. It is located at the first highway bridge over Musconetcong River above the village of Bloomsbury, N. J. The 1903 gage was a vertical 1¼-inch by 6-inch cypress board spiked to the right abutment near the downstream end. It read from 0 to 10 feet, and was graduated with galvanized-iron staples. Gage readings are taken twice each day by Michael Kieffer. Discharge measurements are made from the downstream side of the two-span highway bridge to which the gage is attached. The initial point for soundings is the end of the hand rail on the right bank. The channel is straight for 200 feet above and 100 feet below the station. The current is swift, and both banks are low and liable to overflow. The bed of the stream is composed of gravel. The channel is broken by the central pier of the two-span bridge, and at high stages part of the water flows around the bridge. The bench mark is a square chiseled on the top of the right abutment at its downstream end. Its elevation is 9.63 feet above the gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Musconetcong River near Bloomsbury, N. J., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 3	E. P. Roundey	2.10	390
September 7	do	1.45	146
October 21	Wm. Nunn	2.00	395
December 22	F. H. Tillinghast	2.90	696

Mean daily gage height, in feet, of Musconetcong River near Bloomsbury, N. J., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.50	1.70	1.35	1.65	1.50	17	1.48	1.70	1.80	2.72	1.60	1.75
2	.....	1.52	1.62	1.35	1.62	1.50	18	1.78	1.70	1.90	2.68	2.02	1.65
3	.....	1.50	1.60	1.40	1.60	1.60	19	1.88	1.60	1.70	2.30	1.78	1.50
4	2.05	1.55	1.55	1.30	1.60	1.58	20	1.90	1.68	1.60	1.85	1.70	3.40
5	2.08	2.25	1.52	1.35	1.65	1.58	21	1.90	1.68	1.55	1.98	1.65	3.38
6	2.00	2.22	1.50	1.38	1.65	1.58	22	1.70	1.62	1.48	1.95	1.60	2.80
7	1.85	2.92	1.45	1.35	1.60	1.58	23	2.55	1.60	1.45	1.95	1.65	2.30
8	1.80	2.58	1.45	2.10	1.55	1.62	24	2.05	1.58	1.42	2.65	1.62	2.18
9	1.62	2.20	1.42	4.58	1.58	1.62	25	1.85	1.52	1.35	2.08	1.65	2.08
10	1.70	2.08	1.45	[a]7.50	1.52	1.72	26	1.68	1.56	1.35	2.05	1.55	2.02
11	1.68	2.00	1.48	5.80	1.42	1.62	27	1.62	1.50	1.35	2.02	1.55	1.75
12	1.70	1.90	1.45	4.75	1.58	1.92	28	1.58	1.72	1.45	2.00	1.52	1.92
13	1.72	1.80	1.42	4.20	1.42	2.00	29	1.60	1.92	1.45	1.95	1.50	1.80
14	1.60	1.70	1.40	3.78	1.45	2.02	30	1.70	1.80	1.40	1.75	1.50	1.78
15	1.60	1.72	1.45	3.25	1.58	1.88	31	1.70	1.80	.....	1.65	.....	1.80
16	1.55	1.70	1.48	2.78	1.58	1.80							

[a] Highest recorded - 8 feet.

LEHIGH RIVER AT SOUTH BETHLEHEM, PA.

This station was established September 22, 1902, by Prof. Mansfield Merriman, of Lehigh University, and is being maintained with his cooperation. It is located at the New Street Bridge, between Bethlehem and South Bethlehem, Pa. The mouth of Monocacy Creek is a few rods below the station, and there is a railway and a highway bridge about one-half mile above it. The standard chain gage is attached to the hand rail near the right bank on the lower side of the bridge. The length of the chain from the end of the weight to the marker is 43.77 feet. It is read once each day by Harry E. Edmonds. Discharge measurements are made from the toll highway bridge at New street. This is a nine-span bridge, but the river is confined to three spans except at high stages. The initial point for soundings is the face of the pier on the right bank. The channel is straight for several hundred feet above and below the station. The right bank is high and will not overflow, but on the left bank the river overflows at high stages and joins Monocacy Creek. The bed of the stream is composed of sand and gravel, which is free from vegetation and is permanent. There is one channel, broken by the bridge piers, and there is a fair velocity. The bench mark is bench mark No. 72 of the Lehigh Valley Railroad. It is an iron pin set in the south pier of the New Street Bridge. Its elevation is 232.87 feet above sea level and 22.32 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Lehigh River at South Bethlehem, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 26	John C. Hoyt	3.50	2,964
August 3	do	2.87	1,583
October 12	W. C. Sawyer	6.55	10,536

Mean daily gage height, in feet, of Lehigh River at South Bethlehem, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	4.50	10.30	4.30	3.10	2.30	3.40	4.00	3.50	2.50	2.70	2.50
2	3.50	4.40	7.10	4.00	3.00	2.20	3.10	4.00	3.30	2.40	2.70	2.40
3	5.35	4.20	5.70	4.00	3.00	2.20	3.00	3.90	3.20	2.40	2.70	2.40
4	4.82	5.10	5.00	4.00	3.00	2.10	2.90	3.80	3.00	2.40	2.60	2.40
5	4.50	5.10	4.70	3.80	3.00	2.10	2.80	4.20	2.90	2.40	2.70	2.50
6	4.25	5.10	4.50	3.70	2.90	2.00	2.80	4.00	2.80	2.40	2.70	2.50
7	4.00	5.00	4.30	3.70	2.90	2.00	2.80	4.70	2.80	2.40	2.60	2.50
8	3.90	4.80	4.30	4.50	2.80	2.40	2.80	4.50	2.70	2.40	2.60	2.50
9	3.45	4.50	4.90	6.20	2.80	2.80	2.70	4.00	2.70	5.70	2.60	2.50
10	3.30	3.90	4.70	5.70	2.70	2.70	2.70	3.50	2.80	12.00	2.60	2.40
11	3.20	3.90	4.70	5.00	2.70	2.50	2.60	3.40	2.80	8.00	2.60	2.40
12	3.15	5.10	4.50	4.90	2.70	4.10	2.60	3.20	2.80	6.20	2.60	2.40
13	3.00	4.80	4.30	4.80	2.60	4.30	2.60	3.10	2.70	5.40	2.50	2.60
14	3.15	4.50	4.10	5.50	2.60	3.80	2.50	3.00	2.70	4.90	2.50	3.20
15	3.30	4.20	3.90	6.50	2.50	3.70	2.50	3.00	3.80	4.50	2.50	2.60
16	3.40	4.30	3.90	6.00	2.50	3.40	2.40	3.00	3.80	3.90	2.40	2.60
17	3.30	3.50	3.80	5.60	2.60	3.20	2.40	3.00	3.40	3.90	2.60	2.70
18	3.15	3.40	3.70	5.00	2.50	3.20	2.60	3.00	3.10	4.00	3.90	2.60
19	3.10	3.40	2.50	4.50	2.50	3.10	4.00	2.90	3.00	4.00	3.30	2.40
20	2.80	3.50	2.50	4.40	2.50	3.00	3.90	2.80	2.80	3.80	3.10	4.50
21	4.80	3.50	2.50	4.10	2.50	3.50	3.60	2.80	2.80	3.60	2.90	6.20
22	4.90	3.50	5.00	3.90	2.40	3.30	3.40	2.70	2.70	3.50	3.00	4.60
23	4.10	3.50	6.10	3.80	2.40	3.50	3.30	2.70	2.60	3.40	3.00	4.15
24	3.50	3.50	9.30	3.70	2.40	4.00	3.30	2.60	2.50	3.30	2.80	3.70
25	3.25	3.40	6.90	3.60	2.40	3.70	3.50	2.60	2.50	3.20	2.80	3.60
26	3.40	3.40	5.90	3.50	2.30	3.50	3.60	2.50	2.50	3.10	2.60	3.50
27	3.30	3.30	5.20	3.40	2.30	3.30	3.60	2.50	2.40	3.00	2.50	3.40
28	3.40	9.40	4.70	3.40	2.30	3.10	3.60	2.50	2.50	2.90	2.30	3.30
29	4.40	.....	4.30	3.30	2.30	3.70	3.60	3.40	2.50	2.80	2.50	2.70
30	4.30	.....	4.00	3.20	2.20	3.40	3.80	3.20	2.50	2.70	2.60	2.70
31	4.60	.....	4.60	.....	2.20	.....	4.20	3.90	.....	2.70	.....	2.80

Rating table for Lehigh River at South Bethlehem, Pa., from December 22, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	930	3.2	2,300	4.4	5,170	6.2	9,670
2.1	1,000	3.3	2,510	4.5	5,420	6.4	10,170
2.2	1,070	3.4	2,730	4.6	5,670	6.6	10,670
2.3	1,140	3.5	2,960	4.7	5,920	6.8	11,170
2.4	1,210	3.6	3,190	4.8	6,170	7.0	11,670
2.5	1,290	3.7	3,430	4.9	6,420	8.0	14,170
2.6	1,380	3.8	3,670	5.0	6,670	9.0	16,670
2.7	1,480	3.9	3,920	5.2	7,170	10.0	19,170
2.8	1,600	4.0	4,170	5.4	7,670	11.0	21,670
2.9	1,740	4.1	4,420	5.6	8,170		
3.0	1,910	4.2	4,670	5.8	8,670		
3.1	2,100	4.3	4,920	6.0	9,170		

Estimated monthly discharge of Lehigh River at South Bethlehem, Pa., for 1903.

[Drainage area, 1,274 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	7,545	1,600	3,609	2.83	3.26
February	17,670	2,510	4,967	3.90	4.06
March	19,920	1,290	6,505	5.11	5.89
April	10,420	2,300	5,184	4.07	4.54
May	2,100	1,070	1,428	1.12	1.29
June	4,920	930	2,342	1.84	2.05
July	4,670	1,210	2,305	1.81	2.09
August	5,920	1,290	2,690	2.11	2.43
September	3,670	1,210	1,814	1.42	1.58
October	24,170	1,210	4,179	3.28	3.78
November	3,920	1,140	1,576	1.24	1.38
December	9,670	1,210	2,264	1.78	2.05
The year	24,170	930	3,239	2.54	34.40

NAVESINK RIVER AT PORT JERVIS, N. Y.

A temporary station was established October 16, 1902, at the East Main Street Bridge in Port Jervis, by P. M. Churchill and C. C. Covert. A wire gage was fastened to the ironwork of the bridge on the downstream side, and discharge measurements were made from the upstream side of the bridge to which the gage was attached. It is a single-span bridge with a length of 130 feet between abutments. The initial point for soundings was taken at the right abutment. The bench mark is an anchor bolt in the top of the cemetery wall on the right bank. Its elevation is 27.76 feet above gage datum. At the station the stream is confined to its channel by masonry walls. The bed is composed of rock overlain in part by earth. Gage readings were made twice each day by Edwin J. Earley from the date of establishment of the station until August 3, 1903. On this date the station was discontinued and a new station was established at the suspension bridge at Godeffroy, N. Y., above Port Jervis. The gage heights at Port Jervis were affected at some stages by backwater from the Delaware River, and this effect has been taken into account in computing the daily discharges.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Navesink River at Port Jervis, N. Y., in 1902 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
October 16	P. M. Churchill	7.45	945
November 10	F. H. Tillinghast	7.00	524
1903.			
January 17	F. H. Tillinghast	6.78	517
February 12	do	8.60	2,232
March 6	do	8.10	1,625
March 25	do	11.75	3,760
May 13	do	6.20	250
August 17	do	[a] 2.81	406
September 1	do	[a] 4.14	1,424

[a] Measurements and gage readings taken at suspension bridge near Godeffroy, N. Y.

Rating table for Navesink River at Port Jervis, N. Y., from October 16, 1902, to August 4, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.00	225	7.20	748	8.40	1,990	9.60	3,624
6.10	247	7.30	827	8.50	2,110	9.70	3,783
6.20	269	7.40	906	8.60	2,241	9.80	3,937
6.30	291	7.50	985	8.70	2,372	9.90	4,091
6.40	313	7.60	1,090	8.80	2,503	10.00	4,245
6.50	335	7.70	1,196	8.90	2,634	10.10	4,404
6.60	366	7.80	1,301	9.00	2,765	10.20	4,563
6.70	397	7.90	1,406	9.10	2,907	10.30	4,722
6.80	428	8.00	1,512	9.20	3,049	10.40	4,881
6.90	459	8.10	1,632	9.30	3,191	10.50	5,040
7.00	590	8.20	1,751	9.40	3,333		
7.10	669	8.30	1,871	9.50	3,475		

Mean daily discharge, in second-feet, of Navesink River at Port Jervis, N. Y., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
1902.											
1										1,090	459
2										906	459
3										788	669
4										748	748
5										748	590
6										708	590
7										708	590
8										669	459
9										590	397
10										590	397
11										590	459
12										590	459
13										590	459
14										459	459
15										459	444
16									985	459	524
17									906	459	(a)
18									827	459	2,920
19									827	428	3,470
20									748	(b)	2,840
21									669	(b)	2,650
22									653	(b)	(a)
23									630	428	(a)
24									606	428	(a)
25									590	428	2,170
26									524	428	1,690
27									459	459	1,350
28									2,440	590	1,090
29									(a)	590	985
30									2,570	459	906
31									1,460		866
Mean									992	587	1,056

a Above rating curve and discharge measurements.
b No record.

Mean daily discharge, in second-feet, of Navesink River at Port Jervis, N. Y., for 1902 and 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
1903.											
1	590	(a)	(a)	1,630	335	225	1,750	444	.....	.....	.....
2	590	1,570	(a)	1,140	313	225	1,250	382	.....	.....	.....
3	1,350	2,110	3,050	945	313	225	866	313	.....	.....	.....
4	1,630	2,110	2,310	945	335	225	827	b 412	.....	.....	.....
5	1,250	3,860	2,180	1,040	335	225	590	.....	.....	.....	.....
6	985	2,570	1,690	866	313	225	590	.....	.....	.....	.....
7	827	1,410	1,690	866	313	225	459	.....	.....	.....	.....
8	748	1,090	1,750	1,930	302	236	403	.....	.....	.....	.....
9	669	985	(a)	3,260	291	273	382	.....	.....	.....	.....
10	669	788	(a)	2,180	291	269	360	.....	.....	.....	.....
11	669	827	(a)	1,690	291	280	335	.....	.....	.....	.....
12	669	2,570	(a)	1,300	280	(a)	335	.....	.....	.....	.....
13	653	3,050	(a)	1,090	269	(a)	335	.....	.....	.....	.....
14	444	2,310	3,050	1,040	269	3,260	313	.....	.....	.....	.....
15	397	2,240	2,500	2,050	269	3,780	291	.....	.....	.....	.....
16	397	1,200	2,050	1,990	269	2,910	291	.....	.....	.....	.....
17	422	1,300	1,570	1,460	247	2,180	291	.....	.....	.....	.....
18	397	1,410	1,350	1,140	247	2,050	269	.....	.....	.....	.....
19	382	985	1,200	985	247	1,630	748	.....	.....	.....	.....
20	335	866	1,200	827	247	2,310	459	.....	.....	.....	.....
21	630	669	1,300	708	247	4,400	1,040	.....	.....	.....	.....
22	1,090	630	2,840	630	247	3,710	1,040	.....	.....	.....	.....
23	788	459	(a)	590	247	2,440	2,180	.....	.....	.....	.....
24	459	459	(a)	524	247	3,780	1,040	.....	.....	.....	.....
25	366	412	(a)	444	247	3,050	630	.....	.....	.....	.....
26	1,630	397	3,400	428	247	2,370	412	.....	.....	.....	.....
27	1,870	428	2,110	412	247	1,870	350	.....	.....	.....	.....
28	1,630	3,480	1,510	397	247	1,460	324	.....	.....	.....	.....
29	1,510	.....	1,140	366	247	2,370	291	.....	.....	.....	.....
30	(a)	.....	1,460	341	225	2,570	1,090	.....	.....	.....	.....
31	(a)	.....	2,050	.....	225	.....	708	.....	.....	.....	.....
Mean	829	1,488	1,971	1,107	272	1,742	621	.....	.....	.....	.....

a Above rating curve and discharge measurements. b End of record.

Estimated monthly discharge of Navesink River at Port Jervis, N. Y., for 1902 and 1903.

[Drainage area, 346 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
October	2,570	459	992	2.866	3.30
November	1,090	428	587	1.696	1.90
December	3,470	397	1,056	3.051	3.52
1903.					
January	1,870	335	829	2.395	2.77
February	3,860	397	1,488	4.30	4.48
March	3,400	1,140	1,971	5.696	6.57
April	3,260	341	1,107	3.199	3.57
May	335	225	272	.786	.90
June	4,400	225	1,742	5.034	5.62
July	2,180	269	621	1.794	2.06

NAVESINK RIVER AT GODEFFROY, N. Y.

This station was established by C. C. Covert, assisted by F. H. Tillinghast, August 4, 1903, at which date the station at Port Jervis was discontinued. It is located at the suspension bridge one-fourth mile east of the New York, Ontario and Western Railroad station at Godeffroy, N. Y. The vertical board gage is fastened to the face of the left abutment of the bridge, on the downstream side, and is read twice each day by Miss Fanny Olden. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The bridge has a span of 158 feet between abutments. At low water measurements may be made from a bridge 1 mile downstream, at which the current is swifter, but at which the conditions at ordinary stages are not suitable for accurate measurement. The initial point for soundings at the suspension bridge is the vertical face of the right abutment. The downstream hand rail is marked at intervals of 5 feet with brass-headed nails. The channel is straight for 1,000 feet above and for 300 feet below the station. The current is somewhat sluggish at low water, but has a good measurable velocity at higher stages. The right bank is protected by a stone wall, which prevents overflow; back of the wall the land is low and cultivated. The left bank is high and wooded. Near the abutments the bed of the stream is rocky; in the middle of the channel the bed is composed of sand and coarse gravel. The bench mark is a circular chisel draft on

the downstream end of the left abutment. Its elevation is 14.26 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily gage height, in feet, of Navesink River at Godeffroy, N. Y., for 1903.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	4.18	2.35	12	3.35	2.72	.....	23	2.75	2.45	.....
2	.....	3.85	2.35	13	3.20	2.58	.....	24	2.70	2.40	.....
3	.....	3.65	2.30	14	2.95	2.50	.....	25	2.72	2.40	.....
4	3.70	3.28	2.25	15	2.80	2.45	.....	26	3.32	2.40	.....
5	4.75	3.30	2.28	16	2.70	2.48	.....	27	2.92	2.42	.....
6	4.50	3.05	2.20	17	2.80	2.85	.....	28	2.98	2.40	.....
7	4.80	2.95	2.30	18	2.72	3.85	.....	29	6.06	2.40	.....
8	4.15	2.90	2.62	19	2.65	3.10	.....	30	4.90	2.40	.....
9	3.80	2.80	9.28	20	3.20	2.70	.....	31	4.52	.....	.....
10	3.70	2.80	.....	21	3.20	2.60	.....				
11	3.40	2.90	.....	22	2.90	2.58	.....				

WEST BRANCH OF DELAWARE RIVER AT HANCOCK, N. Y.

This station was established October 15, 1902, by P. M. Churchill, assisted by C. C. Covert. It is located about one-half mile southwest of the Erie Railroad station at Hancock, N. Y., and about 1 mile above the junction of the East and West branches of the Delaware. The original wire gage was attached to the upstream side of the bridge. It was replaced July 20, 1903, by a standard chain gage, which was installed by F. H. Tillinghast. The location and the gage datum were not changed. The length of the chain from the end of the weight to the marker is 30.44 feet. The gage is read twice each day by David Pulver, the collector of tolls at the bridge. Discharge measurements are made from the downstream side of the bridge at which the gage is located. The bridge has a single span of 235 feet. The initial point for soundings is the top of the face of the left abutment on the downstream side. The bridge floor is marked at intervals of 5 feet with black paint. The channel is straight for 400 feet above and for 800 feet below the bridge. The current is swift. Both banks are high and rocky and are not subject to overflow. The bed of the stream is composed of earth and cobblestones. The bench mark is a circular chisel draft on the upstream corner of the left abutment. Its elevation is 24.25 feet above gage datum. The elevation of the top of the pulley is 30.54 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of West Branch of Delaware River at Hancock, N. Y., in 1902 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
October 15	P. M. Churchill	3.95	1,123
1903.			
February 12	F. H. Tillinghast	5.80	4,732
March 25	do	6.40	6,693
May 4	do	2.75	368
May 16	E. C. Murphy	2.51	155
May 28	F. H. Tillinghast	2.55	134
July 21	do	3.10	406
August 31	do	5.34	299

Mean daily corrected gage height, in feet, of West Branch of Delaware River at Hancock, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.80	5.75	8.40	4.65	2.62	2.18	4.05	2.98	4.84	2.54	3.68	5.08
2	3.70	5.20	5.75	4.40	2.70	2.30	3.75	2.75	4.49	2.84	3.48	5.28
3	4.30	5.35	5.25	4.50	2.55	2.28	3.45	2.65	4.19	2.59	3.48	4.43
4	4.85	5.68	4.70	4.10	2.70	2.28	3.25	2.80	4.04	2.64	3.43	3.98
5	4.40	5.95	4.55	4.00	2.70	2.02	3.05	3.60	3.74	2.87	3.48	4.08
6	4.15	5.30	4.75	3.90	2.70	2.20	3.10	3.58	3.54	3.09	3.46	4.88
7	3.95	4.75	4.55	4.05	2.60	2.20	2.90	3.85	3.39	3.04	3.43	4.33
8	3.95	4.50	4.65	4.55	2.70	2.25	2.90	3.40	3.24	4.04	3.48	3.88
9	3.62	4.30	6.95	4.95	2.65	2.40	2.95	3.45	3.19	9.34	3.33	3.78
10	3.50	4.30	6.15	4.80	2.62	2.50	2.85	3.45	3.19	13.45	3.28	5.68
11	3.55	4.10	7.65	4.72	2.50	2.32	2.75	3.35	3.44	7.74	3.28	4.98
12	3.75	5.60	7.65	4.40	2.55	4.60	2.68	3.25	3.34	6.74	3.23	4.73
13	4.70	5.05	6.00	4.25	2.50	5.28	2.55	3.22	3.24	5.74	3.18	4.23
14	5.15	4.35	5.50	4.05	2.55	4.35	2.55	3.00	3.09	5.21	3.13	5.07
15	5.40	4.15	5.20	4.20	2.55	4.05	2.42	3.00	2.99	4.89	3.08	5.37
16	5.30	4.20	4.75	4.05	2.35	3.85	2.48	2.80	2.99	4.69	3.23	5.02
17	5.50	3.70	4.65	3.75	2.52	3.50	2.42	2.90	3.19	4.59	6.13	4.77
18	5.25	3.50	4.65	3.65	2.55	3.45	2.42	2.88	3.39	5.94	6.16	4.82
19	4.90	3.25	4.35	3.55	2.40	3.40	2.82	2.85	3.29	5.54	5.23	4.32
20	4.75	3.60	4.30	3.45	2.35	3.28	2.82	3.52	3.14	5.14	4.78	4.92
21	5.50	3.95	4.20	3.25	2.40	3.92	3.18	3.45	2.99	4.73	4.38	6.82
22	6.30	3.90	4.75	3.20	2.35	3.88	3.25	3.30	2.64	4.58	4.18	5.22
23	6.30	3.80	6.40	3.20	2.18	3.75	3.65	3.05	2.74	4.38	4.18	4.77
24	5.55	3.75	8.40	3.10	2.20	4.05	3.40	3.05	2.67	4.23	4.13	4.67
25	5.85	3.68	6.55	3.12	2.30	3.90	3.10	3.25	2.64	4.08	3.83	4.47
26	5.85	3.75	5.65	3.00	2.25	3.85	2.92	3.85	2.59	3.93	3.38	3.92
27	5.75	3.50	5.20	3.10	2.22	3.70	2.75	3.64	2.47	3.83	3.63	3.57
28	5.85	8.00	4.68	3.10	2.48	3.50	2.70	3.49	2.79	3.78	3.53	3.62
29	7.08	.....	4.60	3.10	2.32	3.70	2.70	7.44	2.54	3.78	3.53	3.47
30	8.00	.....	4.12	3.00	2.25	4.38	2.82	6.24	2.54	3.78	3.93	6.57
31	6.25	.....	5.20	.....	2.30	.....	2.98	5.34	.....	3.68	.....	6.62

EAST BRANCH OF DELAWARE RIVER AT HANCOCK, N. Y.

This station was established October 14, 1902, by P. M. Churchill and C. C. Covert. It is located at the highway bridge one-half mile southeast of the Erie Railroad station at Hancock, N. Y., and 1 mile above the junction with the West Branch of Delaware River. The Erie Railroad bridge is just below the station. The standard chain gage with inclosed scale is attached to the lower chord of the second span from the left end of the bridge on the upstream side. It was installed to replace the old wire gage July 21, 1903, by F. H. Tillinghast. The gage datum was not changed. The length of the chain from the end of the weight to the marker is 32.43 feet. The gage is read twice each day by D. B. Van Etten. Discharge measurements are made from the downstream side of the 5-span iron highway bridge to which the gage is attached.

The bridge has a total span of 425.5 feet between abutments. The initial point for soundings is the face of the right abutment at the top. The channel is straight for 600 feet above and for 300 feet below the station. The current is swift. Both banks are of medium height. and are not subject to overflow. The bed of the stream is composed of rocks and gravel and is not subject to change. There are three channels at low water and five channels at high water. The bench mark is a circular chisel draft on the top of the left abutment on the downstream side. It is marked "B. M." Its elevation is 27.93 feet above gage datum. The elevation of the top of the gage pulley is 32.40 feet above gage datum. During low water the elevation of the water surface at the station is lower than the water surface at the station on the West Branch of the Delaware, but there is no danger of the gage heights being affected by backwater from the West Branch, as there is considerable fall between the gaging station and the junction of the branches.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of East Branch of Delaware River at Hancock, N. Y., in 1902. and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
October 4	P. M. Churchill	4.34	2,320
1903.			
February 12	F. H. Tillinghast	6.17	7,394
March 26	do	5.99	6,578
May 5	do	3.18	691
May 16	E. C. Murphy	2.98	514
May 29	F. H. Tillinghast	2.70	292
July 21	do	3.62	1,255
September 1	do	4.95	3,371

Corrected mean daily gage height, in feet, of East Branch of Delaware River at Hancock, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.85	5.09	10.94	4.79	3.18	2.62	4.02	3.25	4.89	2.79	3.63	4.38
2	3.80	4.89	6.34	4.54	3.16	2.57	3.77	3.08	4.51	2.91	3.58	4.23
3	4.30	5.24	5.59	4.44	3.10	2.57	3.59	3.00	4.24	2.97	3.50	4.40
4	4.75	5.29	5.19	4.58	3.10	2.57	3.45	3.05	4.04	2.89	3.48	4.13
5	4.35	5.99	4.94	4.48	3.16	2.52	3.35	4.35	3.84	2.87	3.56	4.00
6	4.20	5.24	4.89	4.23	3.08	2.52	3.29	4.08	3.71	2.97	3.88	3.98
7	4.04	4.89	4.84	4.28	3.00	2.52	3.25	4.30	3.57	3.01	3.70	4.06
8	4.04	4.59	4.94	4.98	3.03	2.62	3.15	4.00	3.47	3.21	3.56	3.86
9	3.69	4.44	7.59	5.98	2.98	2.75	3.07	3.72	3.39	13.94	3.53	3.78
10	3.59	4.29	6.84	5.63	2.98	2.77	3.05	3.82	3.37	14.24	3.53	3.98
11	3.64	4.19	8.54	5.23	2.93	3.15	3.02	3.70	3.41	8.19	3.48	4.33
12	3.94	6.19	7.69	4.93	2.90	7.12	2.97	3.80	3.34	6.51	3.48	4.48
13	4.24	5.29	6.64	4.73	2.88	6.77	2.92	3.65	3.21	5.69	3.48	4.58
14	4.69	4.94	6.09	4.53	2.86	5.12	2.92	3.48	3.14	5.19	3.40	5.47
15	4.89	4.64	5.84	5.03	3.20	5.02	2.89	3.38	3.09	4.84	3.38	5.07
16	4.89	4.54	5.64	4.53	2.96	4.62	2.95	3.30	3.01	4.61	3.43	4.72
17	4.84	4.24	5.24	4.33	2.88	4.35	2.89	3.45	3.09	4.47	5.23	4.52
18	4.59	3.64	5.04	4.13	2.83	4.19	2.92	3.32	3.67	5.21	6.83	4.37
19	4.29	3.84	4.89	4.03	2.83	3.99	3.12	3.22	3.44	5.07	5.56	4.07
20	4.29	4.14	4.89	3.93	2.78	3.92	3.07	3.30	3.21	4.74	5.08	4.17
21	4.54	4.19	4.79	3.83	2.78	4.37	3.70	3.35	3.09	4.53	4.70	7.57
22	5.04	4.14	6.24	3.73	2.73	5.05	3.40	3.22	3.04	4.38	4.50	5.72
23	4.54	4.04	6.64	3.68	2.70	4.59	5.10	3.18	2.99	4.28	4.38	5.07
24	4.69	4.94	9.29	3.63	2.68	4.79	4.12	3.10	2.97	4.20	4.30	4.85
25	6.59	3.74	6.94	3.56	2.68	4.69	3.72	3.18	2.89	4.10	4.13	4.57
26	6.94	3.84	5.99	3.48	2.68	4.47	3.45	3.78	2.89	3.98	3.88	4.39
27	6.69	3.79	5.39	3.40	2.68	4.22	3.30	3.49	2.87	3.90	4.68	3.87
28	6.19	7.24	5.04	3.38	2.70	4.02	3.18	3.37	2.89	3.86	4.76	4.17
29	6.34	.....	4.74	3.30	2.68	3.95	3.12	7.14	2.91	3.80	4.63	4.09
30	7.49	.....	4.54	3.26	2.68	4.29	3.25	6.29	2.84	3.76	4.58	4.47
31	5.74	.....	5.14	.....	2.68	.....	3.38	6.37	.....	3.70	.....	4.57

SUSQUEHANNA RIVER DRAINAGE BASIN.

Susquehana River rises in New York State and flows in a southwesterly direction until it crosses the Pennsylvania State line, when it changes its course to the southeast, turning again, near Wilkesbarre, to the southwest. It is joined by the West Branch on the western border of Northumberland County, and then flows in a southerly direction to Chesapeake Bay. The West Branch rises in Cambria County, Pa., and flows in a general northeasterly direction until it joins the main stream. Measurements of flow of the Susquehana are made at Binghamton, N. Y., and at Wilkesbarre, Danville, and Harrisburg, Pa., and of the West Branch at Allenwood and Williamsport, Pa. At Binghamton, Chenango River unites with the Susquehanna, and a gaging station is located at this place. Juniata River, which rises in Center County, Pa., flows into the Susquehanna about 15 miles above Harrisburg. Most of its drainage area is mountainous and covered with forest growth. A gaging station is located on this branch at Newport, about 15 miles above the junction of the river with the Susquehanna.

SUSQUEHANNA RIVER AT M'CALL FERRY, PA.

This station is located at a narrow and rocky part of the Susquehanna River about 20 miles above its mouth and 1 mile above the village of that name. It was established on May 17, 1902, by Boyd Ehle while investigating a power development there. For a considerable distance along this portion of the river the bank on the York County shore is the retaining wall of an abandoned canal which can be overtopped only in the greatest floods. The Lancaster shore on the opposite side is made up of almost equally vertical rock, and the railroad which skirts it has never yet been flooded at this point.

The gaging section first selected for this station is located at Duncans Run, where two islands, Hartman and Streepers, divide the river into three channels, ranging in width from 100 to 500 feet. At ordinary low water, however, two of these run dry, thus confining the discharge to the main or westernmost channel. The river bed at this section is of mica schistose rock with some projecting bowlders and large irregularities. The flow, however, is comparatively free from the boils so common in a river of this character.

The discharge measurements at this section are made from a boat held in place by a rope stretched between the towpath and Streepers Island, the gaging points, 10 feet apart, being indicated by a tagged wire, which is also used in keeping the boat parallel to the current of the stream.

In order to provide for measuring the large floods which occur in the winter and spring months, a cable station was established by Mr. Ehle

in the fall of 1902 about 1,000 feet downstream from the Duncans Run section. The banks of the river and the conditions of the river bed are very similar to those at the upper section, the only difference being that the bed is somewhat more irregular. During the low-water period of the fall of 1902 a careful survey was made of the section at the cable station and a contour map with 1-foot intervals was prepared from which the effective areas could be accurately determined, thus eliminating the error in discharge due to possible inaccuracies in the soundings at the time of the measurements. The width of the stream at this point is about 1,300 feet and the maximum depth during a gaging was 46 feet.

The car cable, a three-quarters inch 37-weir strand with a span of 1,450 feet, is anchored to 3-inch eyebolts set in cement in the solid rock on either side of the river. A 2-inch turn-buckle is provided at the York County end to regulate its height above the water. A high cliff on one shore and a large red oak on the other give the cable a 10-foot clearance over the highest floods on record. The car that runs on the cable accommodates two people and is propelled by a sheave provided with a crank. Eighty feet upstream from the main cable is suspended a five-eighths inch secondary cable, along which runs a trolley carrying a guy rope to hold the meter against the current. Measuring points for this section are 50 feet apart, and are indicated by red and white bands painted on the main cable, the intermediate distances being readily estimated by counting the revolutions of the sheaves.

The measurements at both of the above stations are referred to two permanent gages, designated Nos. 2 and 5. These are painted on the rock, and give elevations directly above sea level. Gage No. 2 is located at a point about three-quarters of a mile below the village of McCall Ferry in the tailrace of the proposed power house, and has been read daily since June, 1902. The records in the following tables have been referred to this gage. Gage No. 5 is placed about 2 miles below McCall Ferry at the foot of Cullys Falls, so located in order to be entirely out of the influence of the proposed dam. One of the purposes of such extensive preparations as have been made at this point is to obtain data for determining the coefficient of discharge over ogee-faced weirs under high heads, and it is for use in these investigations that gage No. 5 was established.

The methods used in carrying on the work at the McCall Ferry station are practically the same as those employed by the hydrographers of the United States Geological Survey. Every effort has been made to eliminate any source of error, and vertical velocity determinations were taken wherever possible. At Duncans Run, in order to make these measurements, an 80-pound weight, with pulley and rope attached, was dropped to the bottom, so that the meter could be pulled down without being washed too far from the section. When

the surface-velocity, or 0.6 method, was used, the results were reduced by coefficients determined from these vertical velocity curves. At the cable station the secondary cable, with the aid of the guy rope, made it possible to get vertical velocity measurements at much greater velocities and depths. A No. 12 telegraph wire was found to be more satisfactory at such times for holding the meter than the insulated cable ordinarily used, as it offered less resistance to the current, would allow the meter to sink deeper, and, being less bowed by the water, would show more accurately its depth below the surface. In this way vertical velocity curves were obtained to depths of 20 feet, and in currents of 10 feet per second.

During the highest stages, when the velocity sometimes reaches 17 feet per second, readings could be taken only at the surface. These results were, however, reduced by coefficients determined from the vertical velocity curve for each measuring point.

Discharge measurements of Susquehanna River at McCall Ferry, Pa.

CABLE STATION.[a]

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
February 10	R. H. Anderson	123.90	[b] 85,400
March 2	do	135.90	[b] 290,550
March 3	do	133.60	[b] 250,000
March 4	do	130.00	[b] 174,060
March 5	do	127.20	[b] 129,300
March 6	do	125.20	[c] 103,800
March 7	do	124.20	[c] 85,300
March 12	do	129.40	[c] 160,600
March 18	do	123.40	[c] 77,240
March 25	do	134.30	[b] 273,300
March 27	do	130.10	[b] 175,210
March 28	do	127.60	[b] 136,400
April 3	do	123.80	[b] 80,400
April 9	do	123.30	[c] 76,600
April 16	do	131.50	[b] 209,200
April 18	do	128.80	[b] 152,500
April 22	do	122.60	[b] 66,600
April 25	do	120.70	[c] 46,660
May 4	do	117.85	[c] 24,400
May 14	do	116.50	[c] 16,000
May 23	do	115.72	[c] 13,140
June 5	do	115.17	[c] 9,810
June 17	do	120.00	[c] 38,200

[a] Duncan's Run station and cable station are 1,000 feet apart. [b] Surface velocities. [c] Mutiple points.

Discharge measurements of Susquehanna River at McCall Ferry, Pa.—Continued.

DUNCANS RUN STATION.[a]

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
May 17	Boyd Ehle	116.62	16,880
May 24	do	115.83	12,710
June 9	do	115.30	10,330
June 23	do	116.32	14,440
July 14	do	121.90	55,100
July 16	do	120.12	38,100
July 21	do	117.90	24,200
July 24	do	125.10	95,300
July 26	do	123.82	81,500
September 3	do	114.82	8,130
September 25	do	114.34	6,370
1903.			
June 5	Boyd Ehle	115.17	10,000

[a] Duncan's Run station and Cable station are 1,000 feet apart.

Mean daily gage height, in feet, of Susquehanna River at McCall Ferry, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	20.1	31.00	32.80	23.10	18.60	15.55	23.00	18.00	27.00	15.77	17.80	17.00
2	19.5	29.20	36.00	23.40	18.20	15.50	22.30	17.70	24.80	15.75	17.75	16.80
3	21.3	26.80	33.60	23.80	18.00	15.40	19.90	17.50	23.20	15.50	17.60	16.60
4	22.1	26.50	29.90	23.40	17.80	15.30	19.40	17.20	22.00	15.40	17.50	16.30
5	22.7	31.50	27.00	22.60	17.75	15.20	20.10	17.10	21.00	15.40	17.40	16.80
6	22.9	33.10	25.20	22.10	17.60	15.10	19.95	17.10	20.00	15.40	17.25	16.80
7	23.1	31.20	24.20	22.10	17.50	15.10	19.75	18.00	19.50	15.50	17.70	16.80
8	22.3	28.70	24.30	22.30	17.30	15.50	21.55	19.70	19.00	16.10	16.95	16.60
9	21.1	25.60	24.70	23.10	17.10	15.65	20.85	19.90	18.70	16.70	17.00	16.50
10	(a)	24.00	27.10	23.80	17.00	16.20	20.00	19.60	18.75	20.80	17.00	16.60
11	(a)	22.90	31.00	24.00	16.90	16.90	19.00	19.00	18.75	27.80	17.05	16.30
12	(a)	22.80	29.70	23.50	16.60	17.45	18.70	18.60	18.50	29.20	17.00	16.00
13	(a)	23.00	.....	23.00	16.55	17.50	18.85	18.10	18.75	28.50	16.85	16.60
14	(b)	23.30	29.40	23.00	16.50	18.30	18.50	18.00	18.60	26.40	16.60	16.00
15	(b)	23.60	27.50	(c)	16.25	19.60	18.00	17.65	18.55	23.80	16.50	15.50
16	(b)	24.50	25.30	.....	16.20	19.50	17.50	17.90	18.00	22.00	16.40	15.30
17	18.40	24.90	24.20	31.70	16.15	20.00	17.20	17.90	17.95	20.90	16.70	15.00
18	18.70	24.50	23.30	29.50	16.05	19.70	17.15	18.00	18.00	20.80	16.80	14.70
19	19.00	.....	22.70	26.60	15.95	19.15	19.50	17.70	18.05	21.10	25.60	15.00
20	.....	20.30	22.00	24.80	15.95	18.75	20.55	17.40	18.50	22.50	25.00	16.00
21	19.50	19.30	21.70	23.60	15.95	18.65	21.80	17.10	18.00	23.10	23.10	18.50
22	19.80	19.10	21.80	22.60	15.85	18.40	20.60	16.80	17.60	22.30	21.60	18.60
23	20.00	18.70	22.60	21.80	15.75	18.10	20.00	16.60	17.40	21.30	20.40	19.70
24	20.10	19.50	26.80	21.10	15.85	18.50	19.50	17.00	17.10	20.50	19.70	20.50
25	19.60	20.60	34.10	20.50	15.85	.....	18.95	17.30	16.90	19.80	19.20	19.70
26	19.30	20.40	32.80	20.10	15.85	21.80	18.10	16.95	16.60	19.60	18.80	19.40
27	19.20	20.50	29.80	19.80	15.80	23.60	17.85	16.70	16.30	19.00	18.50	18.40
28	19.50	22.30	27.00	19.50	15.80	23.00	18.20	17.80	16.20	18.70	18.20	17.70
29	20.40	.....	25.20	19.10	.....	22.30	17.80	21.30	16.00	18.40	17.70	17.50
30	21.10	.....	23.90	.....	15.70	22.40	17.50	22.40	15.90	18.10	17.30	17.40
31	22.70	.....	23.50	.....	15.60	.....	18.00	22.20	.....	18.00	.....	16.90

a Slush ice running and piled up over gage.
b River frozen over at neck and foot of Gully Falls.
c River rising fast.

NOTE.—Add 100 to all gage heights to reduce to above sea level.

Rating table for Susquehanna River at McCall Ferry, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
114.0	5,160	116.4	15,610	120.6	44,200	126.0	112,900
114.1	5,500	116.5	16,150	120.8	46,100	126.5	119,900
114.2	5,840	116.6	16,690	121.0	48,000	127.0	127,000
114.3	6,200	116.7	17,240	121.2	50,000	127.5	134,100
114.4	6,560	116.8	17,800	121.4	52,100	128.0	141,400
114.5	6,930	116.9	18,360	121.6	54,300	128.5	148,300
114.6	7,310	117.0	18,930	121.8	56,600	129.0	155,300
114.7	7,700	117.2	20,120	122.0	59,000	129.5	163,400
114.8	8,100	117.4	21,320	122.2	61,500	130.0	172,500
114.9	8,500	117.6	22,560	122.4	64,000	130.5	182,800
115.0	8,920	117.8	23,820	122.6	66,500	131.0	194,100
115.1	9,340	118.0	25,110	122.8	69,000	131.5	205,800
115.2	9,770	118.2	26,430	123.0	71,500	132.0	217,300
115.3	10,210	118.4	27,780	123.2	74,000	132.5	228,600
115.4	10,660	118.6	29,140	123.4	76,400	133.0	240,000
115.5	11,120	118.8	30,500	123.6	78,900	133.5	251,200
115.6	11,580	119.0	31,900	123.8	81,500	134.0	262,000
115.7	12,060	119.2	33,300	124.0	84,200	134.5	273,600
115.8	12,540	119.4	34,700	124.2	87,000	135.0	285,300
115.9	13,040	119.6	36,100	124.4	89,900	135.5	297,200
116.0	13,540	119.8	37,500	124.6	92,800	136.0	309,300
116.1	14,040	120.0	39,100	124.8	95,700		
116.2	14,560	120.2	40,700	125.0	98,600		
116.3	15,080	120.4	42,400	125.5	105,900		

Estimated monthly discharge of Susquehanna River at McCall Ferry, Pa., in 1903.

[Drainage area, 26,766 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	72,700	27,780	43,533	1.626	1.877
February	242,300	29,840	95,082	3.552	3.698
March	309,300	55,400	134,461	5.023	5.791
April	210,400	31,000	78,566	2.935	3.276
May	29,150	11,580	16,826	.628	.724
June	78,900	9,350	29,859	1.115	1.244
July	71,500	19,830	35,636	1.331	1.535
August	87,000	16,690	28,206	1.053	1.214
September	127,000	13,040	34,183	1.277	1.426
October	158,400	10,660	48,757	1.822	2.102
November	107,300	15,610	30,797	1.151	1.284
December	43,300	7,700	19,751	.737	.848
The year	309,300	7,700	49,638	1.854	25.019

SUSQUEHANNA RIVER AT HARRISBURG, PA.

In 1890 regular daily observations of fluctuations of the water surface of the Susquehanna River at Harrisburg were started by E. Mather, president of the Harrisburg water board. These observations have been continued since that time, and have been furnished through the courtesy of Mr. Mather.

The gage is located in the pump well at the pump house of the city waterworks, the well being connected with the river by two large mains. The datum of the gage is the low-water mark of 1804, and is marked on a large sloping rock, about 40 feet out from the left bank at low water and about halfway between the Walnut Street Bridge and the pumping station. The original readings are taken in feet and inches, and for convenience in computations have been reduced to feet and tenths.

The first discharge measurement was made at this station in March, 1897, by E. G. Paul, who has carried on systematic measurements there since that date. The measuring section is at the lower side of the Walnut street toll bridge, at which point the river is divided into two channels by Fosters Island, which is here about 1,200 feet wide. Its banks are low and sloping, and during extreme floods the whole island is overflowed.

At ordinary stages the left channel is 1,350 feet wide and is broken by six bridge piers. The right channel is 1,300 feet wide, and is broken by seven piers. The main banks of the river are high. The bed is composed of hard material and is permanent except in the spans adjacent to the island. The velocity never becomes too sluggish to measure.

During the spring and summer of 1903 a new bridge was built across Susquehanna River at Market street, which is about 1,200 feet below the gaging station. The piers of this new bridge obstruct the channel of the river by between 10 and 15 per cent of the total cross section. The result of this obstruction, as shown by the discharge measurements taken since the erection of the piers, has been to back up the water, thus increasing the gage height at the Walnut street station. On account of this backwater the measurements taken during 1903 show that, in order to use the standard rating table after June 1, 1904, a deduction of 14 per cent is necessary in the daily discharges. The following table gives the data upon which this deduction has been made:

Date.	Gage height.	Observe discharge.	Standard rating table discharge.	Difference in second-feet.	Difference in per cent.
	Feet.				
May 8	2.30	16,280	15,980	300	2
June 2	1.50	8,390	9,520	1,130	12
October 5	1.65	9,116	10,560	1,440	13
November 2	3.08	20,245	24,350	4,100	16

The following pages give the data which have been collected at Harrisburg gaging station during 1903; also the results of the computation of these data:

Discharge measurements of Susquehanna River at Harrisburg, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 8	E. C. Murphy	2.30	16,280
June 2	Hoyt and Holmes	1.50	8,390
October 5	Paul and Sawyer	1.65	9,116
November 2	Eastern Hydrographers	3.08	20,245

Mean daily gage height, in feet, of Susquehanna River at Harrisburg, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.16	11.50	13.41	6.50	3.41	1.50	7.33	3.50	[a]10.29	1.75	3.16	2.50
2	3.66	10.50	16.83	7.25	3.25	1.50	6.00	3.33	8.33	1.75	3.08	2.41
3	3.83	8.75	14.50	7.50	3.00	1.50	5.16	2.91	6.83	1.75	3.00	2.33
4	4.83	8.91	11.00	6.75	2.58	1.50	4.66	2.66	5.66	1.58	2.83	2.16
5	5.58	13.83	9.00	6.50	2.50	1.50	4.08	2.41	5.16	1.58	2.83	2.08
6	5.91	14.58	8.75	5.75	2.33	1.50	4.41	2.50	4.58	1.50	2.66	2.00
7	6.33	12.25	7.66	5.75	2.33	1.50	4.66	2.91	4.00	1.41	2.58	2.00
8	5.83	9.33	8.16	5.75	2.25	1.50	5.33	4.75	3.33	1.83	2.50	2.00
9	5.00	8.25	8.00	5.75	2.16	1.66	5.33	4.66	3.66	2.66	2.50	2.33
10	4.33	7.00	10.58	6.83	2.16	2.25	4.33	4.08	3.83	5.00	2.41	2.16
11	3.41	6.00	12.50	7.00	2.16	2.25	3.83	3.66	3.50	10.66	2.41	1.91
12	2.91	6.16	11.41	6.83	2.16	2.25	3.16	3.50	3.50	11.25	2.41	1.91
13	2.66	6.50	11.91	6.50	2.08	3.16	3.25	3.50	3.50	11.08	2.41	1.91
14	2.25	6.66	10.83	6.50	2.08	3.66	3.25	3.50	3.33	9.25	2.33	2.00
15	2.25	7.50	9.75	8.83	2.08	4.08	2.75	3.00	3.50	7.33	2.33	1.00
16	2.66	7.66	8.33	12.66	2.08	4.33	2.75	3.16	3.16	5.91	2.33	1.00
17	3.00	7.66	7.83	12.75	2.08	4.41	2.58	3.50	2.83	5.16	2.33	1.00
18	3.16	7.00	7.16	10.66	1.83	4.25	2.33	3.33	2.83	4.83	2.50	1.33
19	3.16	6.00	6.50	9.33	1.83	3.83	3.08	3.16	3.16	5.33	8.66	3.16
20	3.16	5.25	6.50	8.00	1.75	3.41	4.50	2.83	3.33	6.50	8.25	4.00
21	3.16	4.08	5.50	6.50	1.75	3.33	5.66	2.58	3.00	6.58	6.50	5.66
22	3.25	4.50	5.66	6.33	1.66	3.33	5.41	2.50	2.83	6.16	6.16	5.58
23	4.16	4.50	6.00	5.83	1.66	3.66	4.33	2.33	2.66	5.50	4.66	5.58
24	4.00	4.33	9.41	5.66	1.66	4.33	3.91	2.41	2.50	4.83	4.33	4.58
25	3.91	4.16	15.16	5.25	1.66	5.58	3.58	2.33	2.41	4.41	4.00	4.41
26	3.50	4.08	14.16	4.58	1.66	6.50	3.16	2.16	2.33	3.66	3.75	4.00
27	3.50	4.58	11.00	4.50	1.66	7.16	3.00	2.16	2.16	3.75	3.33	3.50
28	3.58	5.50	9.58	4.00	1.66	6.50	3.00	2.25	2.08	3.66	2.50	3.08
29	3.75	.....	8.16	3.50	1.58	6.00	2.83	4.16	1.83	3.50	2.50	2.91
30	4.66	.....	6.83	3.50	1.58	5.50	3.00	5.91	1.83	3.33	2.50	2.66
31	8.08	.....	6.83	.....	1.50	.....	3.33	9.25	.....	3.16	.....	2.08

[a] Highest, 10.58, 2 p. m.

Rating table for Susquehanna River at Harrisburg, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.05	2,330	2.4	16,950	5.8	65,000	12.0	174,500
+.0	2,440	2.5	17,960	6.0	68,400	12.5	183,600
.1	2,710	2.6	19,010	6.2	71,900	13.0	193,000
.2	3,000	2.7	20,100	6.4	75,500	13.5	202,500
.3	3,330	2.8	21,210	6.6	79,200	14.0	212,000
.4	3,680	2.9	22,340	6.8	82,900	14.5	221,300
.5	4,070	3.0	23,480	7.0	86,500	15.0	231,000
.6	4,500	3.1	24,620	7.2	90,000	15.5	242,300
.7	4,980	3.2	25,760	7.4	93,400	16.0	254,500
.8	5,500	3.3	26,910	7.6	96,700	16.5	267,400
.9	6,020	3.4	28,130	7.8	100,100	17.0	280,400
1.0	6,550	3.5	29,430	8.0	103,500	17.5	293,600
1.1	7,090	3.6	30,800	8.2	106,900	18.0	306,700
1.2	7,650	3.7	32,200	8.4	110,300	19.0	334,500
1.3	8,240	3.8	33,600	8.6	113,800	20.0	363,100
1.4	8,850	3.9	35,000	8.8	117,300	21.0	392,600
1.5	9,520	4.0	36,400	9.0	120,800	22.0	423,100
1.6	10,200	4.2	39,200	9.2	124,300	23.0	454,600
1.7	10,930	4.4	42,200	9.4	127,800	24.0	487,000
1.8	11,700	4.6	45,400	9.6	131,400	25.0	520,200
1.9	12,500	4.8	48,600	9.8	134,900	26.0	554,400
2.0	13,300	5.0	51,900	10.0	138,400	27.0	589,400
2.1	14,160	5.2	55,100	10.5	147,200		
2.2	15,050	5.4	58,400	11.0	156,300		
2.3	15,980	5.6	61,700	11.5	165,300		

Estimated monthly discharge of Susquehanna River at Harrisburg, Pa., for 1903.

[Drainage area, 24,030 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.	Run-off, per cent of rainfall.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.		
January	105,200	15,510	37,765	1.572	1.812	3.23	56
February	223,200	37,800	143,025	5.952	6.198	3.71	167
March	276,500	60,000	133,500	5.556	6.405	4.58	140
April	188,400	29,430	82,715	3.442	3.840	2.76	139
May	28,130	9,520	14,297	.595	.686	1.27	54
June	76,710	8,190	27,964	1.163	1.298	6.44	20
July	79,640	14,160	32,581	1.355	1.560	4.52	35
August	107,670	12,560	25,581	1.064	1.227	6.48	19
September	123,500	10,410	30,511	1.270	1.417	1.95	73
October	138,300	7,610	45,160	1.880	2.167	4.94	44
November	98,560	14,160	27,289	1.135	1.266	2.02	63
December	53,750	5,630	19,743	.822	0.948	2.42	39
The year	276,500	5,630	51,678	2.150	28.824	44.32	65

JUNIATA RIVER AT NEWPORT, PA.

Juniata River rises in Center County, Pa., and flows in a general southeasterly direction into Susquehanna River 15 miles above Harrisburg. Its drainage area is mountainous and for the most part covered with forest growth. This station was established at Newport, about 15 miles above the mouth of Juniata River, March 21, 1899, by E. G. Paul. The standard boxed chain gage is located on the covered wagon bridge, 800 feet east of the public square at Newport, Pa., being attached to the bridge timbers inside of the bridge near the right bank. The length of the chain from the end of the weight to the marker is 39.54 feet. The bench mark is on the extreme east end of the stone door sill, south front of Butz's store building, near end of bridge. The elevation above gage datum is 28.83 feet. The gage is read once each day by A. R. Bortel. Discharge measurements are made from the lower side of the 4-span wagon bridge, to which the gage is attached. The initial point for soundings is at the end of the woodwork of the bridge on the right bank downstream side. The channel is straight for one-half mile above and below the station. Both banks are high and are not subject to overflow. There is a single channel broken by three bridge piers. The piers do not interfere with the flow of the stream and there is little eddying and boiling near

them. The bed is of hard material and is probably permanent. There is a good measurable velocity at all stages.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Juniata River at Newport, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 9	E. C. Murphy	6.21	10,843
April 2	do	6.21	10,555
May 7	do	3.96	2,963
June 3	Jno. C. Hoyt	3.40	1,525
October 6	W. C. Sawyer	3.40	1,655
November 3	Brundage and Sawyer	3.33	1,604

Mean daily gage height, in feet, of Juniata River at Newport, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1	4.60	8.20	15.50	7.00	3.80	3.50	9.50	3.50	6.10	3.40	3.50	3.30
2	5.30	6.90	12.10	6.30	3.80	3.40	6.10	3.50	5.60	3.40	3.50	3.30
3	5.30	6.70	9.00	5.60	4.10	3.40	5.20	3.40	5.10	3.30	3.30	3.20
4	7.90	10.10	7.50	5.20	4.10	3.40	4.80	3.40	4.50	3.30	3.30	3.20
5	7.50	14.50	6.70	5.20	4.00	3.30	4.50	3.50	4.30	3.30	3.30	3.20
6	6.60	11.50	6.30	5.10	4.00	3.30	5.00	3.50	4.20	3.40	3.30	3.20
7	6.00	8.50	6.00	4.80	4.00	3.30	9.50	3.80	4.10	3.40	3.30	3.20
8	5.00	7.10	5.80	5.30	3.80	4.00	6.80	4.00	4.00	3.90	3.30	3.20
9	5.50	6.50	6.40	5.60	3.80	4.20	5.40	3.80	4.30	4.80	3.30	3.30
10	4.70	5.80	6.90	5.80	3.80	4.20	4.90	3.70	5.00	5.40	3.30	3.35
11	4.30	5.30	6.60	5.60	3.70	4.30	4.50	3.50	4.70	4.80	3.30	3.30
12	4.00	6.10	6.30	5.40	3.60	4.30	4.40	3.50	4.90	4.50	3.30	3.10
13	3.80	6.60	5.90	5.50	3.60	5.00	4.50	3.40	4.60	4.20	3.30	3.10
14	4.40	6.30	5.50	6.60	3.60	4.70	4.40	3.30	4.20	4.10	3.30	3.20
15	4.50	5.90	5.30	13.10	3.50	4.80	4.40	3.30	4.00	3.90	3.30	3.30
16	4.30	6.80	5.00	15.60	3.50	4.70	4.20	4.20	3.90	3.90	3.30	3.20
17	4.40	10.20	4.90	14.00	3.50	4.60	4.00	3.90	3.90	3.80	3.40	3.20
18	4.30	7.90	4.90	9.40	3.50	4.30	5.00	3.50	4.30	4.20	3.50	3.50
19	4.40	6.70	4.70	8.00	3.50	4.10	7.50	3.50	4.60	4.40	3.50	3.70
20	4.30	6.00	4.50	7.10	3.50	4.10	6.00	3.40	4.10	4.20	3.60	3.70
21	4.90	5.40	4.50	6.50	3.50	4.10	5.20	3.40	4.00	4.00	3.70	3.90
22	4.90	5.40	4.70	5.80	3.50	4.30	4.70	3.50	3.90	3.90	3.60	3.90
23	4.80	5.40	5.80	5.40	3.50	4.30	4.40	3.50	3.80	3.80	3.50	3.90
24	4.80	5.00	12.70	5.20	3.50	4.80	4.30	3.30	3.70	3.70	3.50	3.90
25	4.80	5.30	12.20	4.90	3.50	6.00	4.10	3.40	3.60	.....	3.50	3.90
26	4.60	5.10	8.50	4.80	3.40	5.60	3.90	3.40	3.50	.....	3.40	3.90
27	4.40	5.00	7.10	4.80	3.50	5.00	3.80	3.50	3.50	3.50	3.40	3.90
28	4.40	8.90	6.30	4.30	3.50	4.50	3.80	3.50	3.50	3.50	3.40	3.90
29	5.30	.....	5.60	4.10	3.50	4.60	3.70	3.70	3.40	3.50	3.30	3.90
30	8.00	.....	5.50	4.10	3.50	4.90	3.50	8.00	3.40	3.50	3.30	3.90
31	10.20	.....	6.20	.....	3.50	.....	3.50	6.70	.....	3.50	.....	4.20

Rating table for Juniata River at Newport, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.5	230	4.7	5,180	6.9	14,570	10.2	38,500
2.6	320	4.8	5,510	7.0	15,170	10.4	40,300
2.7	430	4.9	5,850	7.1	15,770	10.6	42,200
2.8	570	5.0	6,200	7.2	16,370	10.8	44,100
2.9	750	5.1	6,550	7.3	16,970	11.0	46,000
3.0	950	5.2	6,910	7.4	17,570	11.2	48,000
3.1	1,160	5.3	7,270	7.5	18,170	11.4	50,100
3.2	1,370	5.4	7,640	7.6	18,770	11.6	52,200
3.3	1,580	5.5	8,010	7.7	19,380	11.8	54,300
3.4	1,790	5.6	8,390	7.8	20,000	12.0	56,400
3.5	2,000	5.7	8,770	7.9	20,640	12.2	58,600
3.6	2,210	5.8	9,150	8.0	21,300	12.4	60,800
3.7	2,430	5.9	9,540	8.2	22,700	12.6	63,100
3.8	2,650	6.0	9,930	8.4	24,100	12.8	65,400
3.9	2,880	6.1	10,330	8.6	25,500	13.0	67,700
4.0	3,120	6.2	10,740	8.8	27,000	13.2	70,100
4.1	3,380	6.3	11,200	9.0	28,500	13.4	72,600
4.2	3,650	6.4	11,720	9.2	30,100	13.6	75,100
4.3	3,930	6.5	12,270	9.4	31,700	13.8	77,600
4.4	4,220	6.6	12,830	9.6	33,400		
4.5	4,530	6.7	13,400	9.8	35,100		
4.6	4,850	6.8	13,980	10.0	36,800		

Estimated monthly discharge of Juniata River at Newport, Pa., for 1903.

[Drainage area 3,476 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	38,500	2,650	7,988	2.298	2.649
February	86,700	6,200	18,304	5.266	5.484
March	100,600	4,530	18,444	5.306	6.117
April	102,100	3,380	16,857	4.850	5.411
May	3,380	1,790	2,330	.670	.772
June	9,930	1,580	4,150	1.194	1.332
July	32,500	2,000	7,322	2.106	2.428
August	21,300	1,580	3,090	.889	1.025
September	10,330	1,790	3,915	1.126	1.256
October	7,640	1,580	2,917	.839	.967
November	2,430	1,580	1,776	.511	.570
December	3,650	1,160	2,050	.590	.680
The year	102,100	1,160	7,429	2.137	28.691

WEST BRANCH OF SUSQUEHANNA RIVER AT WILLIAMSPORT, PA.

This station was established March 1, 1895, by George D. Snyder, who was at that time city engineer. On August 16, 1901, a standard chain gage was installed on the upper side of the Market Street Bridge by E. G. Paul. It is read once each day by Henry H. Guise, who is employed in the city engineer's office. The length of the chain from the end of the weight to the marker is 40.29 feet. Discharge measurements are made from the lower side of the Market street iron highway bridge. The initial point for soundings is the face of the abutment on the left bank. The channel is straight for several hundred feet above and below the station, is broken by four bridge piers, and is about 1,000 feet wide at the station. There is a dam about one-half mile above the station. Both banks are high and rocky. The bed of the stream is composed of gravel and silt and will probably change to some extent in the shore spans. The current velocity is sufficient for accurate measurement except at extreme low stages. The bench mark is a cut in the face of the left abutment 10 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of West Branch of Susquehanna River at Williamsport, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	E. C. Murphy	7.12	24,138
April 3	do	5.24	14,675
June 27	E. D. Walker	6.40	20,400
June 4	John C. Hoyt	.85	1,954
October 7	W. C. Sawyer	1.77	3,525

Mean daily gage height, in feet, of West Branch of Susquehanna River at Williamsport, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	9.80	17.7	5.80	2.40	1.00	4.60	2.70	5.80	1.00	1.90	2.00
2	2.50	6.00	14.30	5.60	2.30	.50	4.20	2.30	5.30	1.00	1.70	2.00
3	3.00	7.50	10.20	5.30	2.20	.90	4.00	2.00	4.60	.90	1.70	2.00
4	4.30	(a)	8.30	5.00	2.00	.60	4.40	1.80	4.00	.90	1.60	1.80
5	4.90	15.50	7.20	5.10	2.00	.60	4.00	2.50	3.50	1.00	1.50	1.80
6	5.30	13.20	7.10	4.70	2.00	.60	3.70	3.60	3.10	1.40	1.60	1.80
7	5.00	10.10	7.20	4.50	2.00	.70	6.00	3.80	2.70	1.70	1.50	1.70
8	4.40	7.80	7.60	4.50	1.70	1.00	5.30	4.00	2.50	2.00	1.50	1.70
9	3.70	6.70	b12.20	5.00	1.60	1.40	4.20	3.50	2.40	5.90	1.50	1.60
10	2.20	5.80	12.70	5.40	1.40	1.40	3.50	2.90	2.60	7.80	1.40	1.70
11	2.20	5.10	11.00	5.60	1.40	2.10	3.00	2.60	2.80	6.20	1.40	1.70
12	4.30	5.20	11.10	5.30	1.40	2.20	3.00	2.40	3.40	5.50	1.40	1.40
13	4.20	6.20	10.60	5.80	1.30	3.70	3.00	2.20	3.00	4.60	1.30	1.30
14	4.20	6.70	8.90	6.10	1.30	3.40	2.70	2.00	2.50	4.00	1.20	1.90
15	4.20	6.40	7.80	9.60	1.30	3.60	2.40	1.70	2.30	3.60	1.20	1.50
16	4.20	6.30	6.90	11.70	1.20	4.00	2.20	1.60	2.00	3.30	1.30	1.00
17	4.10	6.30	6.20	10.70	1.20	3.70	2.00	1.80	1.90	3.00	2.80	1.00
18	3.70	6.00	5.70	9.10	1.20	3.40	2.00	1.80	2.50	4.20	12.00	1.00
19	3.70	4.40	5.30	7.60	1.20	2.90	5.40	1.60	2.60	5.30	9.20	1.00
20	3.60	4.00	4.70	6.50	1.20	2.60	8.00	1.50	2.50	5.00	7.40	1.00
21	3.70	4.10	4.40	5.70	1.20	2.50	6.20	1.60	2.30	4.60	5.50	1.60
22	3.40	4.00	4.60	5.10	1.10	2.50	5.50	2.20	2.00	4.00	4.90	2.10
23	3.20	4.50	5.30	4.60	1.10	2.60	5.00	1.80	1.80	3.60	4.40	2.00
24	3.10	3.80	13.30	4.20	1.00	4.10	4.20	1.50	1.60	3.20	4.10	1.90
25	3.10	3.90	12.20	4.00	.90	6.10	3.60	1.50	1.50	3.00	3.80	1.80
26	3.00	3.80	9.50	3.50	.90	9.20	3.20	1.40	1.50	2.80	3.40	1.70
27	3.00	3.60	7.70	3.40	1.00	7.00	2.70	1.50	1.30	2.60	3.00	2.00
28	3.00	c9.85	6.50	3.10	1.00	5.40	2.30	1.80	1.20	2.30	2.50	2.00
29	2.80	.....	5.60	2.90	1.10	4.50	2.10	3.90	1.20	2.20	2.10	2.40
30	3.00	.....	5.00	2.70	1.10	5.20	2.50	7.20	1.10	2.00	1.70	2.30
31	11.00	.....	4.90	.....	1.10	.....	2.80	6.50	.....	2.00	.....	2.40

a 16, 11 p.m. b 13.2, 11 p.m. c 15, 12 p.m., rising 1 foot in 2 hours.

Rating table for West Branch of Susquehanna River at Williamsport, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.2	410	2.2	4,530	6.0	18,330	10.6	47,400
.0	600	2.3	4,770	6.2	19,330	10.8	49,000
.1	710	2.4	5,010	6.4	20,340	11.0	50,600
.2	830	2.5	5,250	6.6	21,360	11.2	52,200
.3	970	2.6	5,500	6.8	22,380	11.4	53,800
.4	1,120	2.7	5,760	7.0	23,400	11.6	55,500
.5	1,280	2.8	6,020	7.2	24,600	11.8	57,200
.6	1,440	2.9	6,300	7.4	25,700	12.0	58,900
.7	1,610	3.0	6,580	7.6	26,900	12.2	60,700
.8	1,780	3.2	7,170	7.8	28,100	12.4	62,500
.9	1,960	3.4	7,780	8.0	29,300	12.6	64,300
1.0	2,140	3.6	8,400	8.2	30,500	12.8	66,100
1.1	2,320	3.8	9,080	8.4	31,800	13.0	67,900
1.2	2,510	4.0	9,690	8.6	33,100	13.2	69,800
1.3	2,700	4.2	10,400	8.8	34,400	13.4	71,700
1.4	2,890	4.4	11,150	9.0	35,800	13.6	73,600
1.5	3,080	4.6	11,940	9.2	37,200	13.8	75,500
1.6	3,270	4.8	12,750	9.4	38,600	14.0	77,500
1.7	3,460	5.0	13,600	9.6	40,000	14.5	82,600
1.8	3,660	5.2	14,500	9.8	41,400	15.0	87,800
1.9	3,860	5.4	15,420	10.0	42,800		
2.0	4,070	5.6	16,370	10.2	44,300		
2.1	4,300	5.8	17,340	10.4	45,800		

Estimated monthly discharge of West Branch of Susquehanna River at Williamsport, Pa., for 1903.

[Drainage area, 5,640 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.	Per cent of rainfall.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.		
January	50,600	4,530	9,948	1.763	2.032	3.09	66
February	93,100	8,400	24,459	4.337	4.516	3.68	123
March	110,700	11,150	35,220	6.245	7.200	4.41	163
April	56,300	5,760	17,825	3.160	3.526	3.23	109
May	5,010	1,960	2,938	.521	.601	1.74	34
June	37,200	1,280	7,929	1.407	1.569	6.03	26
July	29,300	4,070	9,747	1.728	1.992	5.30	38
August	24,600	2,890	6,019	1.067	1.230	5.44	23
September	17,340	2,320	5,890	1.044	1.165	2.08	56
October	28,100	1,960	8,313	1.474	1.699	4.32	39
November	58,900	2,510	8,773	1.555	1.735	2.55	68
December	5,010	2,140	3,519	.624	.719	2.36	30
The year	110,700	1,280	11,715	2.077	27.984	44.23	63

SUSQUEHANNA RIVER AT DANVILLE, PA.

This station, 52 miles below Wilkesbarre and 11 miles above the mouth of the West Branch, was established on March 25, 1899, by E. G. Paul. It is located at the Mill Street Bridge, 600 feet south of the public square, Danville, Pa., near the Pennsylvania Railroad station, South Danville. The box of the standard chain gage is bolted to the hand rail on the lower side of the bridge, 200 feet from the right bank. The length from the end of the weight to the marker is 42.85 feet. The gage is read once each day by E. F. Bell. Discharge measurements are made from the lower side of the Mill Street covered wooden highway bridge. This bridge has a total span of about 1,300 feet. The initial point for soundings is the end of the wooden hand rail on the left bank, downstream side. The channel is straight for about one-half mile above and below the station. The right bank is low and liable to overflow. The left bank is high and is not subject to overflow. The bed of the stream is rocky, with some gravel, and is permanent. There is but one channel, broken by the six bridge piers, which do not obstruct the flow to any considerable extent. The current is moderately rapid, except at very low stages, when it becomes

sluggish. The bench mark is the extreme south end of the stone door sill at the east entrance to the city filtering plant. Its elevation is 31.7 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Susquehanna River at Danville, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 5	E. C. Murphy	9.82	39,600
April 9	do	8.60	33,000
May 9	do	3.44	4,963
October 8	W. C. Sawyer	3.46	5,728

Mean daily gage height, in feet, of Susquehanna River at Danville, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.20	[a]13.80	16.40	8.50	4.10	2.70	6.50	4.10	11.60	3.00	4.80	4.00
2	5.20	[a]12.40	17.60	9.80	4.00	2.60	6.00	3.90	9.85	2.90	4.60	4.60
3	6.10	[a]10.20	14.40	8.90	3.80	2.60	5.55	3.90	8.00	2.90	4.50	5.10
4	6.60	[a]11.20	11.60	7.80	3.70	2.60	5.30	3.70	6.90	2.90	4.40	4.60
5	7.30	[a]14.00	9.60	7.60	3.70	2.50	5.00	4.15	6.05	2.90	4.30	4.00
6	8.20	[a]15.20	8.70	6.30	3.60	2.50	4.70	4.85	5.60	3.00	4.10	3.90
7	7.40	[a]11.80	9.20	7.60	3.50	2.50	4.70	6.70	5.10	3.00	4.10	4.40
8	6.60	[a]9.70	9.60	7.20	3.50	2.80	6.50	6.45	4.90	3.40	4.20	4.50
9	6.00	[a]7.80	10.40	8.80	3.40	2.90	5.30	6.00	4.50	4.70	4.30	4.00
10	5.70	[a]7.00	15.00	9.30	3.30	2.80	4.60	5.60	4.30	12.50	4.30	4.40
11	[a]9.40	[a]9.20	14.50	8.80	3.30	2.70	4.00	5.00	4.20	16.60	4.10	5.10
12	(b)	[a]7.10	15.00	7.90	3.20	3.40	4.00	4.90	4.30	17.00	4.00	.....
13	(b)	[a]7.40	14.80	7.70	3.10	4.10	3.90	4.60	4.30	15.40	3.80	.....
14	(b)	[a]8.50	12.80	7.30	3.10	5.00	3.60	4.70	4.70	11.60	3.80	.....
15	(b)	[a]8.80	11.40	8.10	3.10	5.90	3.50	4.30	4.30	8.95	3.70	.....
16	(b)	[a]8.10	9.60	11.35	3.10	5.65	3.40	4.30	4.00	7.60	3.90	.....
17	(b)	[a]7.00	8.70	11.05	3.00	5.00	3.30	4.10	3.80	6.80	3.90	.....
18	(b)	[a]6.60	7.60	9.05	3.00	4.60	3.20	3.90	4.30	7.50	7.75	.....
19	(b)	[a]5.70	7.60	7.30	3.00	4.25	3.90	3.70	4.30	9.00	10.10	.....
20	(b)	[a]6.00	7.40	7.10	2.90	4.15	4.50	3.50	3.90	10.20	7.80	.....
21	(b)	(b)	7.00	6.40	2.90	4.00	4.40	3.50	4.10	9.40	7.50	.....
22	(b)	(b)	6.80	5.90	2.90	4.30	4.50	3.85	3.90	8.20	6.50	.....
23	(b)	(b)	8.00	5.50	3.00	6.40	4.40	4.50	3.80	7.20	5.80	.....
24	(b)	(b)	15.85	5.30	3.00	6.95	4.10	4.20	3.70	6.50	5.50	.....
25	(b)	(b)	18.05	5.00	2.90	7.75	3.80	3.90	3.40	6.00	5.20	.....
26	(b)	(b)	15.25	4.80	2.90	7.80	5.30	3.70	3.30	5.60	5.00	.....
27	(b)	(b)	12.80	4.70	2.80	8.55	4.90	3.50	3.20	5.40	4.80	.....
28	(b)	10.85	10.70	4.50	2.70	6.90	4.10	3.70	3.20	5.20	4.70	.....
29	(b)	.....	9.30	4.40	2.80	6.80	3.80	5.15	3.20	5.00	4.30	.....
30	(b)	.....	8.30	4.20	2.80	7.30	3.80	10.73	3.00	4.80	4.20	.....
31	[a]14.80	.....	7.80	.....	2.70	.....	3.80	14.65	.....	4.80	.....	.....

[a] Water backed up by ice. [b] River frozen.

Rating table for Susquehanna River at Danville, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	700	3.8	6,880	6.1	19,230	9.8	42,900
1.6	830	3.9	7,330	6.2	19,800	10.0	44,800
1.7	970	4.0	7,780	6.3	20,370	10.2	46,700
1.8	1,120	4.1	8,230	6.4	20,940	10.4	48,600
1.9	1,270	4.2	8,690	6.5	21,510	10.6	50,400
2.0	1,440	4.3	9,160	6.6	22,080	10.8	52,300
2.1	1,620	4.4	9,660	6.7	22,660	11.0	54,300
2.2	1,810	4.5	10,170	6.8	23,240	11.2	56,300
2.3	2,010	4.6	10,700	6.9	23,820	11.4	58,300
2.4	2,230	4.7	11,250	7.0	24,400	11.6	60,400
2.5	2,470	4.8	11,820	7.2	25,600	11.8	62,500
2.6	2,720	4.9	12,390	7.4	26,800	12.0	64,600
2.7	3,000	5.0	12,960	7.6	28,000	12.2	66,700
2.8	3,280	5.1	13,530	7.8	29,100	12.4	68,900
2.9	3,580	5.2	14,100	8.0	30,300	12.6	71,200
3.0	3,900	5.3	14,670	8.2	31,600	12.8	73,500
3.1	4,230	5.4	15,240	8.4	32,800	13.0	75,800
3.2	4,570	5.5	15,810	8.6	34,100	13.5	81,800
3.3	4,920	5.6	16,380	8.8	35,400	14.0	87,800
3.4	5,280	5.7	16,950	9.0	36,700	14.5	94,300
3.5	5,650	5.8	17,520	9.2	38,000	15.0	101,000
3.6	6,040	5.9	18,090	9.4	39,500		
3.7	6,450	6.0	18,660	9.6	41,100		

Estimated monthly discharge of Susquehanna River at Danville, Pa., for 1903.

[Drainage area, 11,070 square miles.]

Month.	Discharge in second-feet.			Run-off	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 4–11, 31 [a]	98,300	16,950	33,574	3.033	1.015
February 1–20, 28 [a]	103,600	16,950	43,752	3.952	3.086
March	146,100	23,240	63,459	5.732	6.608
April	57,800	8,690	27,165	2.454	2.738
May	8,230	3,000	4,612	.417	.481
June	33,800	2,470	12,031	1.087	1.213
July	21,510	4,570	10,347	.935	1.081
August	96,300	5,650	14,242	1.286	1.483
September	60,400	3,900	12,764	1.153	1.286
October	129,600	3,580	30,648	2.768	3.191
November	45,700	6,450	13,380	1.209	1.349
December 1–5	13,500	7,780	10,098	.912	.170
The year	146,100	2,470	23,006	2.078	23.701

[a] River frozen for days not included.

SUSQUEHANNA RIVER AT WILKESBARRE, PA.

Observations of fluctuations of Susquehanna River are made by the Weather Bureau above Wilkesbarre, at Towanda, Pa., where the drainage area is estimated to be 8,000 square miles. The river gage, made of iron 1 foot wide and one-half inch thick, is on the east side of the road bridge over Susquehanna River, and is securely bolted to the masonry of the pier. The graduation is from 0 to 25 feet. The highest water was 29 feet in March, 1869, and the lowest, −0.1, in October, 1895; the danger line is at 16 feet. The elevation of the zero is 633.7 feet.

The Wilkesbarre station was established by E. G. Paul on March 30, 1899. The standard chain gage is located on the upstream side of the Market Street Bridge. The length of the chain from the end of the weight to the marker is 40.83 feet. The gage is read once each day by W. S. Bennett, the bridge keeper.

When this gage was established there was found to be a gage painted on the bridge pier, being a portion of one established by the Weather Bureau. The lower part of this gage, erected in January, 1898, originally consisted of heavy cast-brass plates graduated to feet and tenths. The gage plates were made in 4-foot sections and bolted to the stone bridge pier. The two lower sections of the brass plates had been torn

away by ice, so that there was no graduation below the 8-foot mark, but readings were made by the figures painted on the stone pier. The zero of this old gage is at the base of the dressed-stone portion of the pier, and is reported to be 535 feet above sea level. During low stages of the river the water recedes from the pier, rendering it impracticable to read the gage. So far as could be ascertained, this has not been connected with the city datum. On account of the low water, which in 1897 had gone below the city datum, it was decided to put the zero of the new gage 4 feet below the zero of the old Weather Bureau gage, so as to obviate minus readings. In order, therefore, to compare with former records, it is necessary to add 4 feet to the old figures. The danger mark of this Weather Bureau gage is at 14 feet (or 18 feet on new gage) as at this elevation the west bank of the river is under water in places. River reports from this locality were furnished as early as 1888. During low water measurements were made by wading at a better cross section, at Retreat, 10 miles below Wilkesbarre. The Market Street Bridge is at at an elevation above the river bed such that a length of 65 feet of cable is needed to sound across the section.

Discharge measurements are made from the downstream side of the bridge, which has a total span of 700 feet between abutments. The initial point for soundings is at the end of the iron hand rail on the left bank, downstream side. The channel is straight for about one-fourth mile above and below the station. There is a bar across the river about one-half mile above the station, and another at about the same distance below, with deep water between these two points. This makes a sluggish current at low stages. The right bank is low and overflows at a gage height of about 20 feet. The left bank is above ordinary floods. The bed of the stream is composed of sand and gravel, and is somewhat shifting. There is but one channel broken by three bridge piers. There are a few willows growing under the right span. The bench mark is the extreme west end of the stone door sill of the north entrance to the Coal Exchange building. Its elevation is 32.99 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Susquehanna River at Wilkesbarre, Pa., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 4	E. C. Murphy	13.50	46,112
April 8	do	8.86	23,247
August 4	Jno. C. Hoyt	4.00	4,718
October 10	W. C. Sawyer	19.00	86,500

Mean daily gage height, in feet, of Susquehanna River at Wilkesbarre, Pa., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.50	15.30	20.40	11.20	4.80	3.00	6.90	4.60	13.80	3.60	5.60	7.20
2	11.00	13.10	19.94	12.00	4.60	3.00	6.80	4.60	11.90	3.60	5.60	7.30
3	12.80	13.00	16.28	10.70	4.40	3.00	6.10	4.30	9.90	3.60	5.40	7.50
4	13.00	14.65	13.60	9.70	4.30	2.90	5.50	4.00	8.40	3.60	5.20	6.70
5	13.50	18.78	11.30	9.80	4.20	2.90	5.40	4.80	7.40	3.60	5.00	5.20
6	9.70	16.50	10.50	9.90	4.10	2.90	5.50	6.70	6.70	3.70	5.00	4.50
7	8.10	13.90	12.10	8.70	4.00	2.90	7.30	7.90	6.20	3.80	5.00	4.20
8	7.90	11.30	11.60	8.80	4.00	2.90	7.30	7.60	5.80	4.70	5.20	4.20
9	6.90	10.00	16.20	10.60	4.00	3.00	9.40	6.80	5.53	10.70	5.30	4.30
10	6.80	8.60	18.60	10.80	3.80	3.00	4.80	6.00	5.30	19.20	5.00	4.10
11	10.70	8.00	17.94	9.80	3.70	2.90	4.40	5.70	5.20	21.25	4.90	4.00
12	10.00	8.50	18.91	9.00	3.70	3.60	4.30	5.40	5.30	21.15	4.70	3.70
13	9.50	9.10	17.80	8.90	3.60	6.60	4.00	5.50	6.00	18.15	4.60	3.90
14	9.10	11.00	15.70	8.30	3.50	5.00	3.80	5.20	5.60	13.70	4.50	4.70
15	9.10	10.80	13.20	12.20	3.50	7.50	3.70	4.90	5.20	10.50	4.40	4.80
16	10.00	9.30	11.70	14.20	3.50	6.40	3.60	4.70	4.80	9.00	4.20	5.80
17	10.50	8.40	10.60	12.30	3.40	5.80	3.60	4.50	4.60	8.00	7.90	6.60
18	10.40	7.40	9.90	10.50	3.40	5.20	3.40	4.30	5.20	8.30	12.90	6.80
19	9.60	10.00	9.60	9.00	3.30	5.00	4.30	3.90	4.80	12.50	13.70	6.30
20	8.70	9.20	9.20	8.00	3.30	4.80	4.60	3.70	5.00	12.40	10.80	5.80
21	8.60	9.40	8.70	7.30	3.30	4.70	4.80	3.80	4.80	10.90	8.70	8.90
22	9.40	10.00	8.30	6.80	3.50	6.80	5.10	5.60	4.70	9.40	7.10	9.00
23	9.80	10.50	13.92	6.40	3.30	8.00	4.70	5.30	4.40	8.30	6.70	8.40
24	10.40	10.90	20.88	6.10	3.30	8.93	4.40	5.00	4.20	7.50	6.20	8.00
25	10.00	11.20	21.16	5.90	3.10	9.45	4.40	4.60	4.00	7.00	6.20	7.50
26	9.60	10.40	18.00	5.70	3.10	10.40	6.10	4.40	3.90	6.80	6.10	7.10
27	8.70	9.60	15.40	5.50	3.10	10.20	5.20	4.30	3.80	6.50	5.80	7.20
28	8.20	10.20	12.60	5.30	3.10	8.00	4.50	5.40	3.80	6.20	5.50	10.40
29	8.20	.....	10.70	5.10	3.00	6.90	4.10	9.15	3.70	6.00	6.00	9.70
30	14.54	.....	9.90	4.90	3.00	7.60	4.20	19.40	3.60	5.80	7.70	9.20
31	17.60	.....	9.80	.....	3.00	.....	4.70	16.83	.....	5.60	.....	8.40

Rating table for Susquehanna River at Wilkesbarre, Pa., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	620	4.3	4,370	6.6	12,560	9.8	28,200
2.1	740	4.4	4,570	6.7	13,040	10.0	29,200
2.2	870	4.5	4,780	6.8	13,520	10.2	30,100
2.3	1,000	4.6	5,000	6.9	14,000	10.4	31,100
2.4	1,130	4.7	5,230	7.0	14,480	10.6	32,100
2.5	1,270	4.8	5,460	7.1	14,970	10.8	33,000
2.6	1,420	4.9	5,710	7.2	15,460	11.0	34,000
2.7	1,570	5.0	5,980	7.3	15,950	11.2	35,000
2.8	1,730	5.1	6,260	7.4	16,440	11.4	36,000
2.9	1,890	5.2	6,550	7.5	16,930	11.6	37,000
3.0	2,050	5.3	6,850	7.6	17,420	11.8	37,900
3.1	2,210	5.4	7,170	7.7	17,910	12.0	38,900
3.2	2,370	5.5	7,510	7.8	18,400	12.2	39,900
3.3	2,530	5.6	7,870	7.9	18,890	12.4	40,800
3.4	2,700	5.7	8,270	8.0	19,380	12.6	41,800
3.5	2,870	5.8	8,720	8.2	20,360	12.8	42,800
3.6	3,040	5.9	9,200	8.4	21,340	13.0	43,700
3.7	3,220	6.0	9,680	8.6	22,320	13.2	44,700
3.8	3,400	6.1	10,160	8.8	23,300	13.4	45,700
3.9	3,590	6.2	10,640	9.0	24,300	13.8	47,600
4.0	3,780	6.3	11,120	9.2	25,300	14.0	48,600
4.1	3,970	6.4	11,600	9.4	26,200		
4.2	4,170	6.5	12,080	9.6	27,200		

Estimated monthly discharge of Susquehanna River at Wilkesbarre, Pa., for 1903.

[Drainage area, 9,810 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.	Per cent of rainfall.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.		
January	66,100	13,520	29,280	2.985	3.441	2.64	130
February	84,500	16,440	35,000	3.568	3.715	2.93	127
March	106,100	20,850	53,512	5.455	6.289	4.77	132
April	49,900	5,710	23,329	2.379	2.654	2.30	115
May	5,460	2,050	3,106	.317	.366	1.11	33
June	31,100	1,890	9,970	1.016	1.134	6.38	18
July	26,200	2,700	7,157	.730	.842	4.39	19
August	90,000	3,220	12,305	1.254	1.446	6.51	22
September	47,600	3,040	10,174	1.037	1.157	1.67	69
October	106,900	3,040	27,085	2.761	3.183	6.04	53
November	47,100	4,170	12,154	1.239	1.382	2.21	62
December	31,100	3,220	13,127	1.338	1.543	2.44	63
The year	106,900	1,890	19,683	2.007	27.153	43.32	63

CHEMUNG RIVER AT CHEMUNG, N. Y.

Chemung River is formed at Painted Post, N. Y., by the union of Tioga and Cohocton rivers. The Cohocton Branch lies entirely in the State of New York. Tioga River receives, just above its mouth, Canisteo River, a large tributary, which also has its drainage basin in New York to the south of Cohocton. The drainage of Tioga River above Canisteo is mainly in Pennsylvania. The concentration of the storm waters through three main branches just above Corning favors the formation of excessive floods. Chemung River flows southeasterly through Corning, Elmira, and Chemung, crosses the State line, flows for a short distance in Pennsylvania, then returns to New York and again crosses to Pennsylvania near Waverly, finally emptying into Susquehanna River near Athens, Bedford County, Pa. The total length of the stream in New York State is about 30 miles. It is a sluggish stream, with low banks and a broad valley or flood plain which is often overflowed. It was formerly paralleled by a canal taking its supply from dams across the stream. This has been abandoned, and at present the principal water-power development on the main river is at Elmira.

The topographic features of the drainage basin are, as a rule, bold and broad. The hills rise within a short distance of the stream several

hundred feet on either side, and the upland plateau is to a large extent wooded, with impervious soil, no lake storage, and few marsh areas. Tributaries are ramifying and uniformly distributed, though not very numerous, and dry gulleys or flood channels are common. Dikes have been erected in the cities of Elmira and Corning for protection against floods. One of the highest recorded freshets in the stream occurred June 1, 1889. It was preceded by phenomenal rainfall, aggregating several inches in the course of a few hours on the night of May 31 and June 1. The discharge has been estimated at 67 second-feet per square mile from 2,055 square miles, or 138,000 second-feet.

The gaging station was established September 7, 1903, by R. E. Horton, assisted by C. C. Covert. It is located at the suspension highway bridge, midway between Chemung, N. Y., and Willawana, Pa., near the State line. The bridge has a single span of 395 feet. The gage is a standard chain gage, located near the right end of the bridge on the upstream side. It is read twice each day by Daniel L. Orcutt. Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the face of the right abutment on the downstream side. The channel is straight for 700 feet above and for 800 feet below the station, and the current is smooth. The right bank is high, cleared, and is not subject to overflow. The left bank is of medium height, wooded, and will overflow at high water. The bed of the stream is composed of gravel, and is clean and permanent. There is but one channel at all stages. The bench mark is three nails driven into a telephone pole 70 feet to the right of the initial point for soundings and about 30 feet upstream. It is marked with black paint, "U. S. G. S. B. M." Its elevation is 29.88 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Chemung River at Chemung, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 27	C. C. Covert	2.89	809
September 7	R. E. Horton	3.29	1,354
October 2	H. H. Halsey	2.47	611
October 12	C. C. Covert	6.72	8,766

Mean daily gage height, in feet, of Chemung River at Chemung, N. Y., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	2.24	2.98	2.90	17	2.96	3.92	7.06	2.74
2	.....	2.40	2.88	2.88	18	3.44	7.04	8.13	2.64
3	.....	2.52	3.88	2.88	19	3.46	6.24	5.88	2.64
4	.....	2.57	2.83	2.88	20	3.29	4.90	4.88	2.64
5	.....	2.74	2.86	2.82	21	2.99	4.42	4.26	2.69
6	.....	3.30	2.90	2.59	22	2.84	4.12	3.98	2.74
7	3.29	3.37	3.08	3.69	23	2.54	3.87	3.88	2.79
8	2.24	4.62	2.98	2.79	24	2.34	4.72	3.83	2.79
9	3.19	9.97	4.93	2.69	25	2.84	3.54	3.78	2.79
10	3.16	7.78	2.90	2.64	26	2.29	3.44	3.38	2.74
11	4.84	8.80	2.88	2.49	27	2.24	3.32	3.23	2.69
12	4.56	6.74	2.86	2.49	28	2.24	3.30	3.10	2.54
13	3.84	6.12	2.80	2.69	29	2.22	3.24	3.10	2.44
14	3.46	4.97	2.73	2.69	30	2.26	3.22	3.10	2.54
15	3.22	4.47	2.68	2.69	31	.....	3.13	.....	2.64
16	3.06	4.20	2.76	2.74					

SUSQUEHANNA RIVER AT WASHINGTON STREET BRIDGE, BINGHAMTON, N. Y.

A gaging station was established on this stream July 31, 1901. The gage is located on the upstream side of the left span of the Washington Street Bridge. This bridge is situated about 800 feet upstream from the junction of Chenango and Susquehanna rivers. A rift extends diagonally across the stream underneath the bridge. The gage stands above a stretch of smooth water extending from the crest of the rift to the dam, 2,800 feet upstream, and the gage readings are unaffected by backwater from Chenango River at ordinary stages. Owing to unfavorable conditions underneath the Washington Street Bridge discharge measurements are made at Exchange Street Bridge, 1,900 feet upstream. The bench mark is a chisel draft on the corner of the left bridge abutment on the upstream side. Its elevation is 23.71 feet above gage datum. The gage is read twice each day by E. F. Weeks.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Susquehanna River at Binghamton (Exchange Street Bridge), N. Y., in 1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
April 7	E. C. Murphy	4.13	5,946
May 15	do	2.05	763
May 19	do	1.96	640
June 13	C. C. Covert	5.25	8,726
August 22	do	2.65	2,572
September 3	do	2.00	948
October 1	H. H. Halsey	2.14	962
October 11	C. C. Covert	16.32	49,707
October 13	do	6.35	14,566

[a] Referred uniformly to original gage datum.

Mean daily gage height, in feet, of Susquehanna River at Binghamton, N. Y., 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	.....	.....	1.84	2.21	2.19	2.04	2.49
2	.....	.....	.....	.....	.....	.....	.....	1.96	2.16	2.19	2.02	2.49
3	.....	.....	.....	.....	.....	.....	.....	1.91	2.16	2.16	1.94	2.64
4	.....	.....	.....	.....	.....	.....	.....	1.86	2.21	2.16	1.94	2.56
5	.....	.....	.....	.....	.....	.....	.....	1.86	2.18	2.14	1.96	2.64
6	.....	.....	.....	.....	.....	.....	.....	1.86	2.16	2.06	1.94	2.44
7	.....	.....	.....	.....	.....	.....	.....	1.86	2.06	2.04	1.94	2.32
8	.....	.....	.....	.....	.....	.....	.....	1.91	2.04	1.99	1.94	2.34
9	.....	.....	.....	.....	.....	.....	.....	1.91	2.04	2.04	1.92	2.44
10	.....	.....	.....	.....	.....	.....	.....	1.86	1.96	1.99	1.94	5.21
11	.....	.....	.....	.....	.....	.....	.....	1.94	1.98	2.02	1.92	6.12
12	.....	.....	.....	.....	.....	.....	.....	1.94	2.06	1.96	1.96	5.32
13	.....	.....	.....	.....	.....	.....	.....	1.91	2.04	1.99	2.49	.....
14	.....	.....	.....	.....	.....	.....	.....	1.96	2.01	2.06	2.96	4.62
15	.....	.....	.....	.....	.....	.....	.....	1.94	2.08	2.14	2.79	14.86
16	.....	.....	.....	.....	.....	.....	.....	1.94	2.16	2.32	2.54	13.74
17	.....	.....	.....	.....	.....	.....	.....	1.96	2.21	2.39	2.44	9.24
18	.....	.....	.....	.....	.....	.....	.....	2.11	2.36	.....	2.42	5.66
19	.....	.....	.....	.....	.....	.....	.....	2.16	2.36	2.26	2.36	4.29
20	.....	.....	.....	.....	.....	.....	.....	2.06	2.34	2.24	2.39	3.46
21	.....	.....	.....	.....	.....	.....	.....	3.66	2.24	2.24	2.39	2.96
22	.....	.....	.....	.....	.....	.....	.....	2.98	2.16	2.26	2.32	2.76
23	.....	.....	.....	.....	.....	.....	.....	2.61	2.06	2.24	2.29	3.74
24	.....	.....	.....	.....	.....	.....	.....	4.51	2.06	2.19	2.71	4.66
25	.....	.....	.....	.....	.....	.....	.....	3.86	2.06	2.14	3.42	3.96
26	.....	.....	.....	.....	.....	.....	.....	3.21	2.04	2.09	2.94	3.32
27	.....	.....	.....	.....	.....	.....	.....	2.78	2.00	2.06	2.52	3.26
28	.....	.....	.....	.....	.....	.....	.....	2.46	.....	2.06	2.24	2.86
29	.....	.....	.....	.....	.....	.....	.....	2.36	2.02	2.04	2.34	2.89
30	.....	.....	.....	.....	.....	.....	.....	2.26	2.04	2.04	2.39	3.69
31	.....	.....	.....	.....	.....	.....	1.91	2.31	.....	2.06	.....	4.06

Mean daily gage height, in feet, of Susquehanna River, at Binghamton, N. Y., 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.22	2.56	15.59	5.20	2.85	2.35	5.10	4.90	2.13	4.57	4.60	2.75
2	3.39	2.54	19.22	5.10	2.85	2.37	4.23	5.94	2.13	4.25	4.07	2.73
3	3.22	2.56	17.69	4.87	2.75	2.30	3.60	5.27	2.13	3.67	3.70	2.85
4	3.56	3.24	13.79	4.55	2.65	2.63	3.87	4.51	2.15	3.35	3.47	3.10
5	3.22	2.96	9.19	4.20	2.65	3.07	3.43	3.77	2.13	2.90	3.27	3.33
6	3.14	2.66	6.36	.....	2.67	2.85	3.97	3.45	2.07	2.93	3.13	3.18
7	3.02	2.72	5.59	3.90	2.57	2.63	4.43	3.37	2.05	2.83	3.07	2.98
8	2.82	2.74	5.34	3.83	2.53	2.57	4.35	3.10	2.10	2.77	3.00	2.77
9	2.66	2.79	5.04	4.75	2.45	2.65	4.00	2.97	2.07	2.75	2.83	2.73
10	2.54	2.72	5.74	5.40	2.45	2.60	4.03	2.83	2.25	2.67	2.77	2.85
11	2.52	2.84	5.59	5.70	2.35	2.47	4.77	2.73	2.25	2.55	2.70	2.83
12	2.46	2.64	7.81	5.45	2.33	2.47	4.37	2.75	2.25	2.67	2.65	2.95
13	2.57	2.42	11.19	5.03	2.30	2.57	3.43	2.80	2.23	2.77	2.65	2.83
14	2.46	2.34	11.94	4.70	2.30	2.57	3.08	2.75	2.15	2.90	2.75	2.67
15	2.34	2.24	10.61	4.35	2.27	2.65	2.75	2.59	2.15	2.90	2.67	2.75
16	2.32	2.26	8.42	3.97	2.25	2.65	2.70	2.49	2.10	2.87	2.55	2.98
17	2.24	2.19	11.82	3.70	2.25	2.53	2.63	2.40	2.05	2.75	2.55	7.13
18	2.22	2.14	11.87	3.53	2.15	2.55	2.65	2.35	2.05	2.60	2.53	7.65
19	2.42	2.16	9.47	3.37	2.15	2.50	2.65	2.30	2.05	2.50	2.47	6.70
20	2.64	2.16	6.82	3.17	2.15	2.50	7.27	2.30	2.00	2.60	2.50	5.87
21	2.14	2.19	5.72	3.07	2.25	2.45	10.90	2.35	1.95	2.75	2.45	5.28
22	2.56	2.12	5.49	2.97	2.33	2.47	11.35	2.35	1.95	2.73	2.45	9.45
23	4.76	2.24	5.61	2.85	2.35	2.57	10.00	2.27	2.00	2.57	2.47	10.62
24	5.16	2.29	5.76	2.67	2.25	2.50	8.90	2.27	1.97	2.53	2.45	8.20
25	4.22	2.16	5.44	2.63	2.20	2.37	8.10	2.25	2.00	2.53	2.47	6.28
26	3.39	2.12	4.92	2.55	2.37	2.27	6.37	2.25	2.35	2.50	2.53	5.63
27	3.14	2.42	4.56	2.50	2.55	2.37	5.40	2.20	2.63	2.45	2.70	4.98
28	3.67	5.46	4.44	2.53	2.53	2.37	7.51	2.25	2.55	5.95	2.85	4.48
29	4.02	.....	5.30	2.53	2.47	2.85	6.07	2.27	5.00	8.30	2.90	3.95
30	3.34	.....	5.70	2.60	2.40	6.98	5.00	2.30	3.80	7.15	2.83	3.80
31	2.86	.....	5.53	.....	2.35	.....	5.55	2.17	.....	5.53	.....	3.63

Mean daily gage height, in feet, of Susquehanna River at Binghamton, N. Y., 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	3.40	8.60	12.92	6.65	2.33	1.85	3.35	2.55	6.55	2.07	3.25	2.62
2	3.30	7.20	10.82	5.85	2.27	1.87	3.00	2.43	5.17	2.13	3.07	2.59
3	3.70	7.23	7.75	5.15	2.25	1.85	2.73	2.30	4.30	2.15	2.95	2.65
4	5.15	8.27	6.17	5.05	2.25	1.80	2.57	2.25	3.70	2.10	2.85	2.65
5	5.33	9.60	5.63	4.80	2.23	1.83	2.45	2.50	.....	2.13	2.85	2.62
6	4.63	7.95	6.43	4.33	2.20	1.80	2.35	3.17	.....	2.25	3.05	2.47
7	3.83	6.35	6.30	4.17	2.17	1.77	2.27	3.25	.....	2.35	3.17	2.52
8	3.75	5.00	6.35	4.95	2.15	1.85	2.25	3.03	2.70	2.70	2.97	2.52
9	3.45	4.65	10.75	5.63	2.15	1.80	2.20	2.80	2.67	7.97	2.85	2.57
10	6.05	4.33	10.55	5.05	2.10	1.80	2.17	2.63	2.55	15.49	2.75	2.29
11	5.55	4.20	11.55	4.70	2.05	1.80	2.13	2.73	2.65	16.35	2.72	2.45
12	5.93	5.47	11.47	4.40	2.05	2.77	2.10	2.83	2.67	12.12	2.67	2.55
13	6.00	6.95	9.57	4.03	2.05	5.35	2.10	2.70	2.60	8.17	2.62	2.65
14	6.07	6.07	7.75	3.73	2.05	3.45	2.07	2.60	2.50	5.99	2.59	3.17
15	5.85	4.97	6.65	4.05	2.05	3.03	2.13	2.55	2.37	5.09	2.52	3.22
16	5.80	4.40	6.03	3.97	2.00	2.63	2.07	2.43	2.30	4.49	2.52	3.12
17	5.53	3.65	5.55	3.73	2.00	2.50	2.05	2.33	2.37	4.22	5.70	2.97
18	5.10	3.13	5.45	3.47	2.00	2.45	2.10	2.30	2.50	7.55	6.89	2.85
19	4.60	3.27	5.13	3.23	2.00	2.35	2.17	2.27	2.45	7.89	5.45	2.79
20	4.15	3.57	4.75	3.07	1.95	2.30	2.15	2.27	2.45	6.55	4.25	2.62
21	4.30	3.75	4.50	2.90	1.95	2.53	2.23	2.45	2.35	5.47	3.67	4.37
22	6.53	3.53	5.60	2.77	1.95	3.77	2.25	2.65	2.27	4.82	3.35	5.39
23	6.63	3.55	7.57	2.70	1.95	4.45	3.50	2.40	2.20	4.25	3.29	4.97
24	5.63	3.25	12.11	2.65	1.87	5.03	4.65	2.30	2.23	4.02	3.39	4.25
25	4.80	3.20	11.48	2.60	1.85	4.43	3.43	2.25	2.20	3.92	3.32	4.05
26	4.53	3.15	9.20	2.57	1.85	3.97	2.80	2.70	2.15	3.67	3.05	3.79
27	4.23	2.95	7.15	2.50	1.87	3.40	2.60	4.13	2.10	3.52	2.87	3.72
28	4.20	6.80	6.07	2.45	1.90	2.95	2.45	3.57	2.10	3.45	2.79	3.45
29	5.35	.....	5.70	2.40	1.90	3.03	2.35	10.63	2.10	3.45	2.85	3.57
30	9.68	.....	5.30	2.35	1.87	3.65	2.47	10.53	2.07	3.42	2.85	3.65
31	10.23	.....	6.20	.....	1.85	.....	2.70	8.57	.....	3.35	.....	3.75

Rating table for Susquehanna River at Binghamton, N. Y., from July 31, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.8	315	4.9	7,980	8.0	17,950	11.1	29,060
1.9	525	5.0	8,280	8.1	18,300	11.2	29,420
2.0	740	5.1	8,580	8.2	18,650	11.3	29,780
2.1	960	5.2	8,880	8.3	19,000	11.4	30,140
2.2	1,180	5.3	9,185	8.4	19,350	11.5	30,500
2.3	1,400	5.4	9,495	8.5	19,700	11.6	30,860
2.4	1,625	5.5	9,805	8.6	20,060	11.7	31,220
2.5	1,855	5.6	10,120	8.7	20,420	11.8	31,580
2.6	2,085	5.7	10,440	8.8	20,780	11.9	31,940
2.7	2,315	5.8	10,760	8.9	21,140	12.0	32,300
2.8	2,545	5.9	11,080	9.0	21,500	12.1	32,660
2.9	2,785	6.0	11,400	9.1	21,860	12.2	33,020
3.0	3,025	6.1	11,720	9.2	22,220	12.3	33,380
3.1	3,265	6.2	12,040	9.3	22,580	12.4	33,740
3.2	3,505	6.3	12,360	9.4	22,940	12.5	34,100
3.3	3,755	6.4	12,680	9.5	23,300	12.6	34,470
3.4	4,005	6.5	13,000	9.6	23,660	12.7	34,840
3.5	4,255	6.6	13,320	9.7	24,020	12.8	35,210
3.6	4,505	6.7	13,640	9.8	24,380	12.9	35,580
3.7	4,755	6.8	13,960	9.9	24,740	13.0	35,950
3.8	5,005	6.9	14,280	10.0	25,100	13.5	37,820
3.9	5,255	7.0	14,600	10.1	25,460	14.0	39,720
4.0	5,510	7.1	14,930	10.2	25,820	14.5	41,650
4.1	5,770	7.2	15,260	10.3	26,180	15.0	43,600
4.2	6,030	7.3	15,590	10.4	26,540	15.5	45,550
4.3	6,300	7.4	15,920	10.5	26,900	16.0	47,500
4.4	6,570	7.5	16,250	10.6	27,260	17.0	51,500
4.5	6,845	7.6	16,590	10.7	27,620	18.0	55,500
4.6	7,125	7.7	16,930	10.8	27,980	19.0	59,500
4.7	7,405	7.8	17,270	10.9	28,340	20.0	63,500
4.8	7,690	7.9	17,610	11.0	28,700		

Estimated monthly discharge of Susquehanna River at Binghamton, N. Y., for 1901–1903.

[Drainage area, 2,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1901.					
August	6,845	399	1,475	0.61	0.70
September	1,510	652	988	.41	.46
October	1,625	652	1,034	.43	.50
November	4,055	567	1,454	.61	.68
December	43,210	1,444	7,514	3.13	3.61
1902.					
January	8,730	1,070	3,177	1.32	1.52
February	9,650	1,004	2,058	.86	.89
March	60,300	6,705	19,701	8.21	9.48
April	10,440	1,855	5,285	2.20	2.45
May	2,665	1,070	1,672	.70	.81
June	14,600	1,334	2,373	.99	1.10
July	29,960	2,154	9,587	4.00	4.61
August	11,240	1,114	2,941	1.23	1.42
September	8,280	630	1,420	.59	.66
October	19,000	1,740	4,197	1.75	2.02
November	7,125	1,740	2,734	1.14	1.27
December	27,260	2,246	7,461	3.11	3.59
The year	60,300	630	5,217	2.18	29.82
1903.					
January	25,820	3,755	9,360	3.90	4.50
February	23,660	2,905	9,248	3.85	4.01
March	35,580	6,845	17,275	7.19	8.29
April	13,480	1,510	5,344	2.23	2.49
May	1,466	420	821	.34	.39
June	9,340	252	2,680	1.12	1.25
July	7,265	850	1,914	.80	.92
August	27,260	1,290	4,413	1.84	2.12
September	13,160	894	2,654	1.11	1.24
October	48,900	894	10,108	4.21	4.85
November	14,280	1,901	3,890	1.62	1.81
December	9,495	1,400	3,556	1.48	1.71
The year	48,900	252	5,930	2.47	33.58

CHENANGO RIVER AT COURT STREET BRIDGE, BINGHAMTON, N. Y.

This station was established July 31, 1901. The gage is located on the upstream side of the first span from the right bank of Court Street Bridge, in Binghamton. It is a boxed wire gage secured to the vertical supports of the hand railing by means of U-bolts. The bench mark is a circular chisel draft on the upstream corner of the bridge seat on the left abutment. Its elevation is 34.02 feet above gage datum. The Court Street Bridge stands squarely across the stream, which has a nearly horizontal bed of gravel and small cobblestones, affording a smooth, uniform current for gaging. The channel is obstructed by three masonry piers supporting the four spans of the bridge, 79 feet clear width each, the bridge having a total length of 337 feet between abutments. The bridge is situated 2,500 feet above the mouth of Chenango River. A small rift below the bridge cuts off backwater from Susquehanna River at ordinary stages of the rivers. For periods during freshets or at times when there is an abnormal rise on one stream, accompanied by a similar rise in the other stream, either the Chenango or Susquehanna River record at Binghamton may be affected by backwater, indicating a too great discharge. For freshets of considerable duration the flow of the two streams will be more nearly equalized. Gage readings on Chenango River, as well as those on Susquehanna River at Binghamton, are taken by E. F. Weeks. In estimating run-off of Chenango River the area directly tributary to storage reservoirs, from which diversion is made to supply Erie Canal, has been deducted from the total area naturally tributary to Chenango River. The diversion area of six reservoirs at the head of Chenango River, whose outflow is turned into Erie Canal through Oriskany Creek, is 30 square miles.

The diversion area of De Ruyter reservoir at the head of Tioughnioga River, whose outflow is turned into Erie Canal through Limestone Creek, is 18 square miles. These two areas have been subtracted from the natural drainage area of 1,582 square miles, giving 1,534 square miles as an effective area. This estimate is approximate, as no allowance for direct inflow to feeder channels from additional areas, nor for waste into the original stream, has been made. The gross area from which more or less run-off is diverted is about 105 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Chenango River at Binghamton, N. Y. (Court Street Bridge), in 1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
April 6	E. C. Murphy	7.72	3,695
May 15	do	5.49	538
June 13	C. C. Covert	8.06	2,877
August 21	do	6.72	2,243
October 1	H. H. Halsey	5.51	709
October 10	C. C. Covert	19.81	28,300
August 19	J. C. Hoyt	5.62	601

[a] Gage readings referred to original datum.

Mean daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1								5.18	5.58	5.70	5.46	6.12
2								5.12	5.75	5.50	5.30	6.33
3								5.10	5.58	5.51	5.25	6.60
4								5.10	5.50	5.68	5.28	6.52
5								5.05	5.42	5.54	5.26	6.19
6								5.20	5.28	5.50	5.25	5.95
7								5.05	5.22	5.46	5.25	5.90
8								5.10	5.20	5.47	5.22	6.02
9								5.20	5.18	5.40	5.23	6.08
10								5.20	5.15	5.37	5.21	8.14
11								5.22	5.15	5.34	5.13	10.00
12								5.20	5.18	5.33	5.26	8.82
13								5.18	5.30	5.42	6.85	.....
14								5.12	5.48	6.47	6.46	8.48
15								5.15	5.35	6.40	6.19	19.54
16								6.35	5.42	6.08	6.11	17.67
17								5.90	5.55	5.89	6.10	12.61
18								5.60	5.62	5.85	6.06	9.41
19								5.48	5.55	5.80	6.06	8.11
20								5.40	5.45	5.82	6.00	7.39
21								5.55	5.45	5.78	5.95	6.84
22								5.58	5.30	5.75	5.95	6.66
23								5.48	5.22	5.70	5.94	7.26
24								6.70	5.20	5.66	6.71	8.18
25								6.20	5.25	5.57	7.78	7.41
26								5.65	5.24	5.48	7.18	6.88
27								5.38	5.25	5.45	6.63	6.83
28								5.30	.....	5.39	6.05	6.50
29								5.25	5.15	5.40	6.20	6.52
30								5.20	5.88	5.35	6.32	7.20
31								5.20	.....	5.39	.....	7.36

Mean daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.62	6.31	18.75	8.65	6.54	6.25	8.58	8.46	5.58	7.28	8.04	6.54
2	6.64	6.25	22.75	8.61	6.32	6.13	7.88	9.46	5.54	7.26	7.56	6.48
3	6.74	6.13	21.65	8.45	6.22	6.00	7.39	8.47	5.56	6.68	7.26	6.68
4	6.91	6.34	17.35	8.10	6.22	6.27	7.43	7.82	5.48	6.28	6.98	7.24
5	6.64	6.20	12.80	7.82	6.22	7.00	7.13	7.32	5.46	6.04	6.84	7.14
6	6.61	6.19	9.98	.....	6.12	6.63	7.46	7.00	5.44	6.28	6.74	6.74
7	6.52	6.16	9.25	7.60	6.12	6.35	8.20	7.02	5.48	6.56	6.71	6.61
8	6.30	6.20	9.02	7.58	6.12	6.35	8.00	6.87	5.46	6.44	7.58	6.51
9	6.22	6.21	8.68	8.12	6.12	6.37	7.80	6.80	5.48	6.46	6.44	6.26
10	6.12	6.08	9.45	8.50	6.00	6.35	7.88	6.57	5.86	6.31	6.34	6.18
11	6.14	6.10	9.28	8.98	5.97	6.20	9.23	6.52	6.08	6.14	6.28	6.56
12	6.02	5.98	11.60	8.78	5.92	6.37	8.40	6.77	5.81	6.16	6.24	6.54
13	5.87	5.90	15.08	8.48	5.87	6.30	7.40	6.72	5.66	6.16	6.48	6.24
14	5.88	5.84	15.78	8.22	5.82	6.35	6.96	6.40	5.61	6.36	6.41	6.01
15	5.89	5.77	14.18	7.80	5.77	6.25	6.68	6.24	5.56	6.64	6.31	6.11
16	5.91	5.86	11.98	7.42	5.72	6.23	6.56	6.22	5.46	6.31	6.16	6.04
17	5.88	5.76	15.86	7.18	5.74	6.25	6.56	6.10	5.41	6.11	6.11	10.58
18	5.76	5.78	15.72	7.05	5.72	6.15	6.48	6.04	5.36	6.01	6.08	10.94
19	5.78	5.74	13.10	6.90	5.62	6.05	6.80	6.00	5.36	5.96	6.06	9.91
20	5.78	5.71	10.48	6.80	5.77	6.05	11.36	6.00	5.31	6.81	6.11	9.08
21	5.66	5.64	9.40	6.72	6.05	6.53	15.02	5.71	5.28	6.86	6.06	8.51
22	6.02	5.67	9.20	6.64	5.93	6.28	15.02	6.00	5.26	6.51	6.08	12.84
23	8.24	5.68	9.32	6.52	5.83	6.33	13.52	5.91	5.31	6.34	6.08	14.03
24	8.66	5.66	9.38	6.40	5.77	6.16	12.34	5.88	5.28	6.31	6.16	11.28
25	7.62	5.68	8.95	6.32	6.00	6.00	11.47	5.84	5.31	6.31	6.21	9.31
26	6.86	5.73	8.48	6.20	6.35	6.06	9.62	5.81	5.54	6.21	6.28	8.71
27	6.86	6.08	8.15	6.20	6.63	6.18	8.62	5.71	5.76	6.16	6.78	8.24
28	7.28	8.92	8.15	6.14	6.35	6.16	11.62	5.78	5.66	9.30	7.06	7.64
29	7.39	.....	8.95	6.14	6.25	6.73	9.70	5.74	7.64	11.71	6.78	7.24
30	6.85	.....	9.28	6.30	6.23	10.56	8.62	5.74	6.44	10.41	6.61	7.28
31	6.40	.....	8.98	.....	6.20	.....	9.30	5.66	.....	8.96	.....	6.98

Mean daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	6.76	12.04	16.49	10.14	5.81	5.06	6.59	5.57	10.01	5.51	6.88	6.22
2	6.64	10.61	14.34	9.14	5.76	5.11	6.42	5.52	8.66	5.56	6.72	6.08
3	7.21	10.56	11.18	8.56	5.74	5.11	6.12	5.45	7.83	5.81	6.68	6.20
4	8.78	11.94	9.71	8.51	5.71	5.06	5.97	5.45	7.29	5.83	6.55	6.20
5	8.64	13.38	9.06	8.24	5.68	5.06	5.89	6.57	6.96	5.83	6.50	6.15
6	7.96	11.46	10.14	7.78	5.64	5.06	5.82	6.49	6.66	7.33	6.92	6.12
7	7.34	9.81	10.01	7.66	5.61	4.94	5.85	6.47	6.46	6.71	6.82	6.08
8	7.24	8.54	10.08	8.76	5.58	5.24	5.77	6.32	6.31	6.66	6.58	6.05
9	6.98	8.16	14.68	9.11	5.56	5.11	5.67	5.99	6.19	11.94	6.48	6.05
10	9.56	7.84	14.28	8.54	5.56	5.06	5.57	6.22	6.13	19.06	6.40	5.90
11	9.34	7.76	15.26	8.18	5.56	5.11	5.47	6.52	6.36	19.91	6.40	5.90
12	9.36	9.01	15.24	7.81	5.51	5.71	5.47	6.27	6.49	15.48	6.32	6.00
13	9.26	10.24	13.16	7.51	5.51	7.97	5.42	6.27	6.19	11.42	6.25	6.30
14	9.08	9.28	11.31	7.26	5.48	6.62	5.42	6.07	6.03	9.45	6.22	6.35
15	9.14	8.21	10.26	7.48	5.46	6.29	5.42	5.95	5.93	8.58	6.15	6.15
16	9.14	7.84	9.56	7.41	5.46	6.12	5.49	5.79	5.89	7.95	6.15	6.10
17	8.96	7.24	9.08	7.21	5.46	5.92	5.57	5.69	5.86	7.78	9.03	6.10
18	8.54	6.44	9.14	6.98	5.41	5.72	5.49	5.69	6.21	11.55	10.10	6.05
19	7.86	6.68	8.78	6.76	5.38	5.75	5.72	5.59	6.23	11.72	8.50	5.92
20	7.38	6.71	8.36	6.56	5.36	5.82	5.89	7.07	5.99	10.20	7.42	5.98
21	7.74	6.88	8.16	6.44	5.36	6.62	5.79	6.89	5.89	9.08	6.92	7.35
22	9.84	6.81	9.48	6.36	5.34	8.67	5.87	6.29	5.81	8.40	6.75	8.35
23	9.86	6.91	11.38	6.31	5.26	8.19	6.67	5.99	5.71	7.88	6.72	8.10
24	8.71	6.76	15.73	6.24	5.26	8.99	7.15	5.79	5.69	7.72	6.85	7.48
25	7.98	6.68	14.96	6.11	5.26	8.32	6.09	5.79	5.66	7.55	6.78	7.35
26	7.96	6.64	12.56	6.11	5.21	7.87	5.77	7.63	5.61	7.25	6.40	7.18
27	7.66	6.56	10.54	6.04	5.21	7.27	5.65	7.59	5.56	7.15	6.32	6.92
28	7.71	9.96	9.54	5.96	5.21	6.77	5.57	6.89	5.61	7.10	6.38	6.48
29	8.74	.....	9.16	5.88	5.24	6.69	5.57	14.61	5.59	7.20	6.18	6.48
30	13.31	.....	8.61	5.86	5.21	6.89	5.65	14.36	5.59	7.18	6.20	6.50
31	13.74	.....	9.78	.....	5.16	.....	5.59	12.11	.....	7.10	.....	6.45

Rating table for Chenango River at Binghamton, N. Y., from August 1, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.0	160	7.9	3,950	10.8	8,970	13.7	14,670
5.1	256	8.0	4,100	10.9	9,160	13.8	14,880
5.2	352	8.1	4,250	11.0	9,350	13.9	15,090
5.3	450	8.2	4,400	11.1	9,540	14.0	15,300
5.4	550	8.3	4,550	11.2	9,730	14.1	15,510
5.5	650	8.4	4,700	11.3	9,920	14.2	15,720
5.6	760	8.5	4,850	11.4	10,110	14.3	15,930
5.7	875	8.6	5,020	11.5	10,300	14.4	16,140
5.8	995	8.7	5,190	11.6	10,490	14.5	16,350
5.9	1,115	8.8	5,360	11.7	10,680	14.6	16,560
6.0	1,235	8.9	5,530	11.8	10,870	14.7	16,770
6.1	1,365	9.0	5,700	11.9	11,060	14.8	16,980
6.2	1,495	9.1	5,880	12.0	11,250	14.9	17,190
6.3	1,625	9.2	6,060	12.1	11,450	15.0	17,400
6.4	1,755	9.3	6,240	12.2	11,650	15.5	18,450
6.5	1,885	9.4	6,420	12.3	11,850	16.0	19,500
6.6	2,025	9.5	6,600	12.4	12,050	16.5	20,600
6.7	2,165	9.6	6,780	12.5	12,250	17.0	21,700
6.8	2,305	9.7	6,960	12.6	12,450	17.5	22,800
6.9	2,450	9.8	7,140	12.7	12,650	18.0	23,950
7.0	2,600	9.9	7,320	12.8	12,850	18.5	25,100
7.1	2,750	10.0	7,500	12.9	13,050	19.0	26,300
7.2	2,900	10.1	7,680	13.0	13,250	19.5	27,500
7.3	3,050	10.2	7,860	13.1	13,450	20.0	28,800
7.4	3,200	10.3	8,040	13.2	13,650	21.0	31,400
7.5	3,350	10.4	8,220	13.3	13,850	22.0	34,000
7.6	3,500	10.5	8,400	13.4	14,050	23.0	36,600
7.7	3,650	10.6	8,590	13.5	14,250	24.0	39,200
7.8	3,800	10.7	8,780	13.6	14,460		

Estimated monthly discharge of Chenango River at Binghamton, N. Y., for 1901–1903.

[Drainage area 1,534 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1901.					
August	2,165	208	576	0.38	0.44
September	1,091	304	524	.34	.38
October	1,846	480	807	.53	.61
November	3,800	285	1,204	.78	.87
December	27,630	1,115	4,750	3.10	3.57
1902.					
January	5,105	827	1,960	1.28	1.48
February	5,530	804	1,339	.87	.91
March	35,950	4,325	11,717	7.64	8.81
April	5,700	1,417	3,246	2.12	2.37
May	2,067	782	1,307	.85	.98
June	8,495	1,235	1,820	1.19	1.33
July	17,400	1,859	6,011	3.92	4.52
August	6,510	827	2,002	1.30	1.50
September	3,575	410	809	.53	.59
October	10,680	1,187	2,539	1.66	1.91
November	4,175	1,313	1,999	1.30	1.45
December	15,405	1,248	4,273	2.79	3.22
The year	35,950	410	3,252	2.12	29.07
1903.					
January	14,775	2,081	5,289	3.44	3.97
February	14,050	1,807	5,291	3.44	3.58
March	20,600	4,325	10,114	6.59	7.60
April	7,770	1,067	3,210	2.09	2.33
May	1,007	314	608	.40	.46
June	5,700	103	1,737	1.13	1.26
July	2,825	570	1,039	.68	.78
August	16,560	600	2,812	1.83	2.11
September	7,500	716	1,763	1.15	1.28
October	28,540	661	6,243	4.07	4.69
November	7,680	1,430	2,385	1.55	1.73
December	4,625	1,115	1,886	1.23	1.42
The year	28,540	103	3,532	2.30	31.21

PATAPSCO RIVER DRAINAGE BASIN.

Patapsco River is formed by the junction of the North Branch and the South, or Piney, Branch near Marriotsville, Md., and flows in a southeasterly direction into Chesapeake Bay 13 miles south of Baltimore. Both branches rise in the central part of Maryland. The river carries a small volume of water, but has considerable fall, so that a large number of small water powers have been developed along its course. These are made valuable by their close proximity to a large city. The drainage basin is a hilly country largely under cultivation.

PATAPSCO RIVER AT WOODSTOCK, MD.

This station was established August 6, 1896, by E. G. Paul. The original wire gage was destroyed when the bridge was repaired January 20–25, 1899. A new wire gage was established January 30, 1899, on the same datum. A standard chain gage was installed by W. C. Sawyer, November 11, 1903, on the upper side of the bridge. The datum was not changed. The length of the chain from the end of the weight to the marker is 28.28 feet. The gage is read twice each day by David Donovan. Discharge measurements are made from the upper side of the iron highway bridge to which the gage is attached. It is located 1½ miles below the junction with the North Branch and near the railroad station. The initial point for soundings is on the right bank, the points for sounding being stenciled on hand rail. The channel is straight for 150 feet above and several hundred feet below the station. At ordinary stages the river flows in one channel 100 feet wide; at high stages it flows in two channels 220 feet wide. The velocity is rapid. Both banks are high and are not subject to overflow. The right bank is without trees; the left bank is wooded. The bed of the stream is rough and is composed of bowlders and cobblestones. It is subject to some change at extreme high water. The bench mark is a United States Geological Survey standard copper bolt set in the face of the retaining wall at the entrance to the college grounds at the north end of the bridge. Its elevation is 22.06 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Patapsco River at Woodstock, Md., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 14	E. C. Murphy	4.48	5.97
September 15	Paul and Sawyer	3.90	2.71
November 11	W. C. Sawyer	3.99	2.66

Mean daily gage height, in feet, of Patapsco River at Woodstock, Md., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.25	4.50	5.50	5.00	4.40	4.45	5.25	4.45	4.45	3.95	3.90	3.85
2	4.40	4.45	4.75	4.85	4.45	4.30	5.30	4.45	4.30	3.95	3.95	3.85
3	9.00	4.45	(a)	4.80	4.45	4.25	5.15	4.45	4.25	3.95	3.95	3.85
4	5.10	5.50	(a)	4.70	4.45	4.25	6.35	4.35	4.15	3.95	3.85	3.85
5	4.95	4.45	4.80	4.70	4.45	4.55	6.75	4.35	4.05	3.95	3.95	3.85
6	4.85	4.45	4.60	4.75	4.45	5.10	4.25	4.25	4.05	3.95	3.90	3.85
7	4.65	4.45	4.65	5.05	4.45	(a)	4.25	4.25	4.05	3.95	3.90	3.85
8	4.60	4.45	4.75	4.75	4.45	(a)	4.25	4.15	4.05	3.95	3.90	3.85
9	4.55	4.45	4.65	4.85	4.40	(a)	4.15	4.05	4.05	3.95	3.90	3.85
10	4.30	4.40	4.60	4.70	4.35	(a)	4.05	4.05	4.00	3.90	3.90	3.85
11	4.45	4.60	4.50	4.55	4.40	(a)	4.05	4.00	4.05	3.90	3.85	3.85
12	4.60	4.45	4.45	4.65	4.40	(a)	5.50	4.00	4.05	3.95	3.95	3.85
13	4.50	4.45	4.45	4.80	4.30	4.60	5.80	4.05	4.05	3.90	3.90	3.65
14	4.50	4.45	4.45	6.00	4.30	4.45	4.50	4.05	4.05	3.95	3.80	3.85
15	4.45	4.55	4.35	6.35	4.30	4.30	4.45	4.05	4.05	3.95	3.65	3.95
16	4.35	4.95	4.30	5.95	4.30	4.20	4.45	4.05	4.05	3.95	3.95	4.05
17	4.50	4.50	4.45	5.45	4.25	4.25	4.45	4.15	4.05	3.95	3.85	4.05
18	4.10	4.45	4.35	5.15	4.25	4.25	4.45	4.15	4.00	3.95	3.75	4.05
19	4.05	4.55	4.35	4.95	4.25	4.25	4.55	4.15	4.00	3.95	3.75	4.05
20	4.05	4.55	4.40	4.85	4.20	7.15	4.50	4.15	4.00	3.95	3.75	6.10
21	7.20	4.55	4.55	4.85	4.20	4.70	4.45	4.15	4.00	3.95	3.80	4.30
22	4.85	4.55	4.60	4.80	4.20	4.35	4.35	4.15	4.00	3.95	3.80	4.05
23	4.60	4.55	b11.20	4.85	4.10	4.60	4.25	4.05	4.00	3.95	3.75	4.05
24	4.45	4.55	5.95	4.80	5.30	4.35	4.25	4.05	4.00	3.95	3.80	4.05
25	4.45	4.55	5.25	4.70	4.35	4.25	4.25	4.15	4.00	3.95	3.85	4.05
26	4.40	4.60	5.05	4.65	4.25	4.35	4.30	4.15	3.95	3.95	3.85	4.05
27	4.35	4.60	5.05	4.55	4.15	4.40	4.25	4.05	3.95	3.95	3.85	4.05
28	6.65	7.80	5.05	4.55	4.20	4.40	4.25	7.25	3.95	3.95	3.85	4.10
29	4.90	.....	5.05	4.50	4.25	c13.70	4.35	5.80	3.95	3.95	3.85	4.05
30	4.50	.....	5.05	4.45	5.15	5.20	4.45	4.45	3.90	3.85	3.85	4.05
31	4.55	.....	5.05	.....	6.10	.....	4.50	4.40	.....	3.95	.....	4.05

a Observer sick. b Highest record, 3.30 and 6 p. m., 12. c Highest record, 8 a. m., 16.

Rating table for Patapsco River at Woodstock, Md., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.5	145	4.2	400	4.9	910	5.6	1,600
3.6	170	4.3	460	5.0	1,000	5.7	1,700
3.7	200	4.4	520	5.1	1,100	5.8	1,800
3.8	230	4.5	590	5.2	1,200	5.9	1,900
3.9	270	4.6	660	5.3	1,300		
4.0	310	4.7	740	5.4	1,400		
4.1	350	4.8	820	5.5	1,500		

Tangent at 5.0 feet gage height. Differences above this point 100 per tenth.

Estimated monthly discharge of Patapsco River at Woodstock, Md., for 1903.

[Drainage area, 251 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	5,000	330	902	3.59	4.14
February	3,800	520	751	2.99	3.11
March [a]	7,200	460	1,014	4.04	4.66
April	2,350	555	948	3.78	4.22
May	2,100	350	592	2.36	2.72
June [b]	9,700	400	1,018	4.06	4.53
July	2,750	330	766	3.05	3.52
August	3,250	310	535	2.13	2.46
September	555	270	333	1.33	1.48
October	290	250	287	1.14	1.31
November	290	185	252	1.00	1.12
December	2,100	185	352	1.40	1.61
The year	9,700	185	646	2.57	34.88

[a] Mar. 3 and 4 estimated. [b] June 7 to 12 estimated.

POTOMAC RIVER DRAINAGE BASIN.

Potomac River is formed by the junction of the North and South branches, about 15 miles below Cumberland, Md. Regular gaging stations have been maintained during 1903 as follows:

North Branch at Piedmont, W. Va.
South Branch near Springfield, W. Va.
Antietam Creek near Sharpsburg, Md.
North Branch of Shenandoah River near Riverton, Va.
South Branch of Shenandoah River near Front Royal, Va.
Shenandoah River at Millville, W. Va.
Potomac River at Point of Rocks, Md.
Monocacy River near Frederick, Md.

MONOCACY RIVER NEAR FREDERICK, MD.

This station was established August 4, 1896, by E. G. Paul, at the county bridge on the toll road leading from Frederick to Mount Pleasant, Md. It is 4 miles northeast of Frederick, about 2,000 feet above the mouth of Israel Creek, and 3,000 feet below the mouth of Tuscarora Creek. The drainage area is 1,000 square miles at the mouth of the river. At the gaging station it is 665 square miles. The original wire gage has been replaced by a standard chain gage,

which is located in the middle of the first span from the right bank, being attached to the bridge floor on the lower side of the bridge. The length of the chain from the end of the weight to the marker is 35.20 feet. The gage is read twice each day by E. L. Derr, a farmer who lives near Frederick, Md. Discharge measurements are made from the two-span iron highway bridge. The initial point for soundings is a cross cut in the face of the parapet wall on the lower wing of the right abutment. The channel is straight for 300 feet above and 100 feet below the bridge. The bridge has a total span of 310 feet. The channel at this point is divided by a small, low island which serves as a foundation for the middle pier of the bridge. The right channel is measured from the lower side of the bridge and the left channel from the upper side, as these sections are freer from rocks than a continuous section on either side of the bridge. The pier and island obstruct the flow to some extent, causing dead water for 20 feet to the right of the pier at low water and eddies at high water. Both banks are low, liable to overflow, and covered with a fringe of trees, but all water passes beneath the bridge. The bed is composed of gravel and cobblestones, except near the banks, where it is composed of silt and is subject to change. The bench mark is a hole drilled in the top of a coping stone on the lower wing of the right abutment about 100 feet back from the initial point for soundings. Its elevation is 29.17 feet above gage datum.

The observations of this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Monocacy River near Frederick, Md., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 13	E. C. Murphy	6.49	1,282
April 17	E. G. Paul	11.03	4,708
April 18	do	9.40	3,733
September 14	Paul and Sawyer	4.60	356
November 10	W. C. Sawyer	4.32	212

Mean daily gage height, in feet, of Monocacy River near Frederick, Md., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.50	7.60	21.40	7.90	5.60	6.50	9.50	5.30	6.50	4.40	4.30	4.30
2	15.02	7.30	9.50	7.40	5.50	6.40	8.10	5.10	5.90	4.40	4.30	4.20
3	13.35	8.30	8.10	6.90	5.50	6.10	7.50	4.90	5.50	4.30	4.30	4.20
4	10.50	[a]16.35	7.90	7.90	5.50	5.10	8.10	4.90	5.40	4.30	4.30	4.20
5	9.50	10.50	7.50	7.20	5.40	4.90	11.50	4.90	5.20	4.30	4.30	4.10
6	8.20	7.90	7.20	6.50	5.30	4.90	9.50	4.90	5.00	4.30	4.30	4.10
7	7.30	7.50	6.90	6.90	5.30	5.80	7.30	5.40	4.90	4.40	4.30	4.60
8	6.90	7.30	7.50	7.50	5.30	5.80	6.20	5.20	4.80	5.20	4.30	4.20
9	6.30	7.50	8.60	12.20	5.20	5.40	6.10	5.10	5.40	7.20	4.30	4.20
10	6.90	6.90	7.40	7.90	5.10	5.10	5.90	4.90	7.20	5.20	4.30	4.20
11	9.60	7.10	7.20	7.20	5.00	5.80	5.80	4.90	6.90	6.10	4.30	4.20
12	9.30	10.50	7.10	6.70	4.90	8.10	9.15	4.80	5.50	5.90	4.30	4.10
13	8.00	7.50	6.30	7.40	4.90	6.50	18.80	4.80	4.90	5.60	4.30	4.10
14	8.40	7.30	6.20	[b]19.30	4.80	6.20	8.50	4.70	4.70	5.20	4.30	4.20
15	8.20	7.80	6.20	[c]21.46	4.80	5.80	7.50	4.70	4.60	5.10	4.30	4.50
16	8.20	11.20	6.20	20.40	4.70	5.40	6.80	7.50	4.60	4.90	4.30	4.60
17	7.90	7.90	6.10	11.56	4.70	5.20	6.50	7.10	6.50	4.90	4.40	4.80
18	7.30	7.40	5.90	9.40	4.80	5.60	8.20	6.20	11.10	5.50	4.90	4.60
19	7.30	7.10	5.90	8.40	4.80	5.40	11.50	5.90	5.80	5.40	4.70	4.20
20	7.20	6.90	5.80	7.90	4.70	7.20	6.90	5.70	5.20	5.20	4.50	6.50
21	8.50	6.70	5.80	7.40	4.70	7.50	6.40	4.90	4.90	4.90	4.40	12.00
22	11.70	6.40	9.40	7.10	4.70	6.40	6.20	4.70	4.80	4.70	4.30	6.50
23	8.60	6.20	[d]7.10	6.70	4.70	5.70	5.60	4.60	4.70	4.60	4.30	4.90
24	7.10	6.20	18.20	6.50	6.50	6.30	5.40	4.50	4.70	4.60	4.30	4.80
25	6.50	6.20	8.60	6.40	6.10	5.90	5.30	4.50	4.60	4.50	4.30	4.70
26	6.30	6.20	7.90	6.20	5.40	5.60	5.20	4.80	4.50	4.50	4.30	4.60
27	6.10	7.30	7.50	6.10	4.90	5.60	5.20	4.70	4.50	4.40	4.30	4.50
28	9.80	[e]21.20	7.10	5.90	4.90	5.60	5.10	[f]10.50	4.40	4.40	4.20	4.50
29	10.60	.....	6.50	5.70	4.80	[g]21.23	5.10	12.10	4.40	4.40	4.20	4.60
30	11.20	.....	9.50	5.70	[h]14.80	14.90	5.40	7.90	4.40	4.30	4.20	4.50
31	8.10	.....	13.90	.....	7.50	.....	5.40	7.40	.....	4.30	.....	4.50

[a] Highest record, 17.1, in afternoon.
[b] Highest record, 20.4, 5.10 p. m.
[c] Highest record, 22.6, 7.30 p. m.
[d] Highest record, 21.9, 6.30 p. m.
[e] Highest record, 23.4, in afternoon.
[f] Highest record, 15.5, 6.10 p. m.
[g] Highest record, 25.4, 6.30 p. m.
[h] Highest record, 16.1, 5.30 a. m.

Rating table for Monocacy River near Frederick, Md., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.1	190	4.8	420	5.5	730	6.2	1,120
4.2	210	4.9	460	5.6	780	6.3	1,190
4.3	235	5.0	500	5.7	835	6.4	1,260
4.4	270	5.1	540	5.8	890	6.5	1,340
4.5	305	5.2	580	5.9	945		
4.6	340	5.3	630	6.0	1,000		
4.7	380	5.4	680	6.1	1,060		

Tangent at 6.4 feet, gage height. Differences above this point 80 per tenth.

Estimated monthly discharge of Monocacy River near Frederick, Md., for 1903.

[Drainage area, 665 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	8,140	730	3,011	4.53	5.22
February	13,100	1,120	2,836	4.26	4.44
March	13,260	890	2,999	4.51	5.20
April	13,300	835	3,133	4.71	5.26
May	7,980	380	857	1.29	1.49
June	13,140	460	1,650	2.48	2.77
July	11,180	540	2,149	3.23	3.72
August	5,820	305	1,021	1.54	1.78
September	5,020	270	779	1.17	1.31
October	1,900	235	485	.73	.84
November	460	210	249	.37	.41
December	5,740	190	523	.79	.91
The year	13,300	190	1,641	2.47	33.35

POTOMAC RIVER AT POINT OF ROCKS, MD.

This station was established by C. C. Babb, February 17, 1895, at the iron toll bridge at Point of Rocks, Md. It is located near the Point of Rocks tunnel, on the Baltimore and Ohio Railroad, and near the Chesapeake and Ohio Canal, which is on the left bank of the river.

As originally placed the gage was located in the third span of the bridge from the north shore. The next year (1896) the wire became rusted and broke frequently, and a new wire gage was placed in the east side of the first span of the bridge, and referred to a different datum. During 1897 there was a further change in the length of the gage, which was not recorded, and therefore it has been necessary to discard the records during those two years—that is, 1896 and 1897. The length of the cable of the original wire gage was 44.22 feet. The measurements of 1895 are considered correct within themselves, but there was a difference between the datum of that gage and that of the present standard of 0.4 foot, making it necessary to deduct that amount from the gage readings of 1895 in order to reduce them to the present datum.

On January 25, 1898, the gage was referred to a bench mark, and the observations since that date have been referred to this datum. This bench mark is a copper bolt in a large capstone on the lower wing wall of the north abutment, about 10 feet from the north end

of the first iron truss and 41.75 feet above the datum of the gage. A second bench mark was established in July, 1904. It is a cross chiseled on the lower step of the upstream wing wall on the left bank of the river, being just across the towpath, 15 feet from the canal. Its elevation is 24 feet above gage datum.

A standard boxed chain gage was installed at this station September 2, 1902, to take the place of the wire gage then in use. It is bolted to the guard rail on the lower side of the bridge in the second span from the left bank. The length of the chain from the end of the weight to the marker is 44.22 feet.

Discharge measurements are made from the eight-span iron toll bridge. The initial point for soundings is the left end of the lower guard rail, 0.4 foot beyond the center of the end pin, on the downstream side of the bridge. The channel is straight for 500 feet above and 200 feet below the station. It is 1,300 feet wide, broken by 7 bridge piers. Both banks overflow only at extremely high water and are not wooded. In the two right spans the bed is composed of mud and is subject to some change; in the other spans the bed is composed of gravel and cobblestones and is permanent. The current does not flow at right angles with the bridge in all of the spans, and a correction should be applied. The bench mark in present use is the copper bolt, to which the wire gage was referred in January, 1898.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Potomac River at Point of Rocks, Md., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 12	E. C. Murphy	4.89	20,871
April 17	J. C. Hoyt and E. G. Paul	13.10	86,022
Do	do	13.70	91,934
April 18	do	9.60	58,388
September 14	Paul and Sawyer	1.50	3,770
November 9	W. C. Sawyer	1.12	2,140

Mean daily gage height, in feet, of Potomac River at Point of Rocks, Md., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.60	6.50	14.25	7.70	3.00	3.70	8.70	1.70	2.00	1.20	1.10	1.10
2	2.40	6.10	15.30	7.00	2.90	4.90	5.80	1.70	2.10	1.10	1.10	1.10
3	4.90	6.00	8.90	6.10	2.80	4.00	4.50	1.60	2.20	1.10	1.00	1.10
4	11.65	6.30	6.60	5.00	2.80	3.40	4.00	1.70	2.10	1.10	1.00	1.10
5	10.30	8.20	5.70	4.90	2.80	3.00	3.50	1.80	2.00	1.00	1.00	1.10
6	7.60	9.20	5.30	4.60	2.70	2.60	4.70	1.90	1.90	1.00	1.00	1.10
7	5.70	6.70	5.00	4.30	2.70	2.40	8.15	2.30	1.80	1.00	1.00	1.10
8	4.80	6.30	4.80	4.10	2.60	6.40	5.80	2.30	1.70	1.10	1.10	1.10
9	4.20	5.20	4.60	4.50	2.50	8.20	4.00	2.20	1.60	2.30	1.10	1.00
10	3.50	4.50	4.80	6.10	2.40	7.40	3.40	2.00	1.50	2.00	1.10	1.00
11	3.00	4.10	5.40	5.60	2.30	6.50	3.00	2.90	1.50	1.90	1.00	1.00
12	2.80	3.70	5.00	5.40	2.30	5.10	3.50	2.80	1.40	1.80	1.00	1.00
13	2.70	3.70	4.60	5.30	2.20	5.30	5.60	2.50	1.40	1.80	1.00	1.00
14	2.60	3.90	4.30	5.60	2.10	6.00	3.90	2.30	1.50	1.70	1.00	1.00
15	2.70	3.90	4.00	14.45	2.10	5.60	3.50	2.00	1.50	1.70	1.00	1.00
16	2.80	4.00	3.80	15.10	2.00	4.50	3.20	2.00	1.40	1.60	1.00	1.20
17	2.90	6.80	3.60	14.00	2.00	4.00	3.00	1.90	1.50	1.50	1.10	1.70
18	2.80	7.40	3.40	10.40	1.90	3.60	2.80	1.80	2.60	1.50	1.10	1.50
19	2.80	6.00	3.20	7.80	1.90	3.20	2.80	1.80	4.50	1.50	1.10	1.40
20	2.80	4.90	3.10	6.70	1.90	3.00	3.10	1.70	2.90	1.60	1.10	1.50
21	2.90	4.50	3.00	5.50	1.80	2.80	2.80	1.70	2.40	1.60	1.10	1.60
22	3.60	4.20	3.10	5.00	1.80	2.60	2.50	1.60	2.00	1.50	1.10	1.70
23	4.40	4.10	5.10	4.50	1.80	2.40	2.30	1.60	1.90	1.50	1.10	1.70
24	3.80	3.80	7.00	4.10	1.90	2.50	2.10	1.50	1.70	1.40	1.20	1.60
25	3.30	4.20	12.10	3.80	2.00	3.30	2.00	1.40	1.60	1.40	1.10	1.60
26	3.10	4.40	8.60	3.60	2.00	3.60	2.00	1.30	1.40	1.30	1.00	1.60
27	2.80	4.50	6.60	3.50	2.10	3.20	1.90	1.30	1.30	1.30	1.00	1.60
28	3.60	5.40	5.30	3.40	2.30	2.70	1.90	1.50	1.30	1.20	1.30	1.60
29	6.20	.....	4.70	3.20	2.40	6.20	1.80	2.10	1.20	1.20	1.10	1.70
30	7.30	.....	4.50	3.10	2.60	12.15	2.00	2.50	1.20	1.10	1.10	1.70
31	7.00	.....	5.10	.....	2.80	.....	1.80	2.10	.....	1.10	.....	1.60

Rating table for Potomac River at Point of Rocks, Md., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	400	1.4	3,286	2.8	9,870	5.4	25,380
0.1	425	1.5	3,681	2.9	10,395	5.6	26,720
0.2	455	1.6	4,106	3.0	10,925	5.8	28,080
0.3	500	1.7	4,550	3.2	11,990	6.0	29,485
0.4	570	1.8	5,005	3.4	13,075	6.2	30,920
0.5	710	1.9	5,465	3.6	14,180	6.4	32,410
0.6	900	2.0	5,925	3.8	15,305	6.6	33,930
0.7	1,122	2.1	6,385	4.0	16,450	6.8	35,460
0.8	1,356	2.2	6,855	4.2	17,620	7.0	37,000
0.9	1,616	2.3	7,335	4.4	18,830	7.2	38,620
1.0	1,906	2.4	7,825	4.6	20,080	7.4	40,260
1.1	2,221	2.5	8,325	4.8	21,370	7.5	41,080
1.2	2,556	2.6	8,835	5.0	22,700		
1.3	2,911	2.7	9,350	5.2	24,040		

Tangent at 7.2 feet gage height. Differences above this point 820 per tenth.

Estimated monthly discharge of Potomac River at Point of Rocks, Md., for 1903.

[Drainage area, 9,654 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	75,110	7,825	19,744	2.05	2.36
February	55,020	14,740	25,315	2.62	2.73
March	105,040	10,925	29,944	3.10	3.57
April	103,400	11,455	32,232	3.34	3.73
May	10,925	5,005	7,411	.77	.89
June	79,210	7,825	20,562	2.13	2.38
July	50,920	5,005	14,799	1.53	1.76
August	10,395	2,911	5,607	.58	.67
September	19,450	2,556	5,321	.55	.61
October	7,335	1,906	3,473	.36	.42
November	2,911	1,906	2,119	.22	.25
December	4,550	1,906	3,091	.32	.37
The year	105,040	1,906	14,135	1.46	19.74

SHENANDOAH RIVER AT MILLVILLE, W. VA.

This river, formed by the junction of the North Fork and the South Fork at Riverton, Va., flows in a northeasterly direction into West Virginia, where it empties into the Potomac at Harpers Ferry.

Observations of the height of Potomac River at the junction of Shenandoah River have been made by the Weather Bureau at Harpers Ferry, W. Va. The gage is on the west face and north end of the second abutment of the old railroad bridge from the West Virginia side of the river. It is of Portland cement, 15 inches wide, plastered on the face of the pier extending to 32 feet, and continued on the iron upright of the bridge to 36 feet. The top surface of the 6 by 6 inch capstone corresponds to the 32-foot mark on the gage. The elevation is 235.5 feet above mean sea level.

The United States Geological Survey station was established April 15, 1895, by C. C. Babb. It is located about one-fourth mile above the Baltimore and Ohio Railroad station at Millville, W. Va. The highway runs within a few rods of this stream at the station. It is best reached by driving from Harpers Ferry, W. Va. The vertical gage is spiked to a large sycamore tree on the left bank a few hundred feet downstream from the cable. It is read once each day by W. R. Nicewarner, the railroad station agent. Discharge measurements are made by means of a three-fourths inch cable, car, and tagged wire. The cable, which is suspended over the branches of two large sycamore trees and is securely anchored to the bank at both ends, has a total span of 500 feet. The initial point for soundings is the side of a tree nearest the river at the cable on the left bank. The channel is straight for several hundred feet above and below the station, and the current is swift and unobstructed. Both banks are low, liable to overflow, and are without trees. There is but one channel at all stages. The bed of the stream is composed of mud and rocks. Bench mark No. 1 is a copper plug in the upstream side of the base of the second tree downstream from the gage, from which it is distant 64 feet. Its elevation is 6.68 feet above the zero of the gage. Bench mark No. 2 is the upper surface of the head of a wire nail driven horizontally in a blaze on the base of the first tree upstream from the gage. Its elevation is 7.42 feet above the zero of the gage. Bench mark No. 3 is the upper surface of the head of a wire spike driven in a blaze on the tree to which the gage is fastened, on the side away from the river; elevation, 9.43 feet above zero.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by W. C. Sawyer in 1903:

August 26: Gage height, 1.00 foot; discharge, 1,107 second-feet.

Mean daily gage height, in feet, of Shenandoah River at Millville, W. Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.70	4.00	7.20	6.40	2.50	4.40	4.60	1.30	1.20	1.10	0.90	0.70
2	1.70	3.60	6.50	5.00	2.40	3.80	4.20	1.35	2.20	1.10	.90	.70
3	6.10	3.30	5.00	4.40	2.30	3.20	3.00	1.30	2.70	1.10	.90	.70
4	8.70	3.30	4.20	4.10	2.20	2.50	2.75	1.50	2.05	1.05	.90	.65
5	5.90	3.80	3.80	3.90	2.15	2.20	2.50	1.60	1.70	1.05	.95	.60
6	4.75	4.20	3.50	3.70	2.10	2.00	3.40	1.90	1.55	1.00	1.00	.60
7	4.00	3.70	3.25	3.50	2.10	3.90	4.65	2.00	1.45	1.00	.90	.60
8	3.50	3.30	3.20	3.30	2.05	9.20	3.70	1.70	1.30	1.80	.90	.55
9	3.10	2.70	3.60	3.30	2.00	6.50	2.30	1.50	1.25	2.10	.90	.60
10	2.80	2.50	3.40	3.30	1.90	8.90	2.00	1.55	1.20	2.00	.90	.80
11	2.70	2.30	3.30	3.20	1.85	4.90	1.95	1.40	1.20	1.80	.90	.70
12	2.70	2.10	3.20	3.00	1.80	4.60	1.90	1.40	1.30	1.65	.90	.70
13	2.20	2.30	3.20	3.10	1.75	4.00	2.70	1.35	1.20	1.55	.90	.70
14	2.30	2.70	3.00	5.40	1.70	4.30	2.60	1.30	1.20	1.50	.85	.80
15	2.00	2.60	2.95	7.80	1.70	3.60	2.80	1.30	1.20	1.40	.85	.80
16	2.30	2.60	2.80	6.60	1.65	3.10	2.70	1.25	1.10	1.30	.85	1.10
17	2.20	3.30	2.70	6.10	1.65	2.80	2.20	1.25	1.30	1.30	.90	.50
18	2.35	4.60	2.60	5.00	1.60	2.60	2.00	1.20	2.10	1.25	.90	.70
19	2.30	4.10	2.55	4.40	1.55	2.40	1.90	1.50	4.60	1.20	.85	.80
20	1.95	3.60	2.50	3.90	1.55	2.10	1.80	1.45	3.10	1.20	.85	.90
21	2.20	3.40	2.50	3.70	1.50	2.00	1.70	1.30	2.70	1.20	.85	1.10
22	3.50	3.30	2.50	3.60	1.50	2.00	1.65	1.25	2.20	1.15	.85	1.00
23	6.00	3.00	4.10	3.30	1.50	1.90	1.60	1.20	1.80	1.10	.80	1.20
24	3.40	3.00	7.30	3.10	1.50	1.90	1.55	1.10	1.60	1.05	.80	1.40
25	2.80	3.20	7.60	3.00	1.50	1.85	1.50	1.05	1.50	1.00	.80	1.20
26	2.60	3.50	5.70	2.90	1.80	1.80	1.50	1.00	1.40	1.00	.80	.80
27	2.30	3.50	4.30	2.80	1.80	2.65	1.45	.95	1.30	1.00	.75	.90
28	3.35	4.00	3.80	2.70	1.70	3.20	1.35	1.10	1.25	.95	.70	1.00
29	6.90	.....	3.40	2.65	1.70	5.20	1.30	1.80	1.20	.95	.60	.90
30	5.20	.....	3.40	2.55	1.85	5.70	1.25	1.25	1.15	.95	.60	.80
31	4.50	.....	5.50	.....	2.05	.....	1.25	1.20	.....	.95	.....	.80

Rating table for Shenandoah River at Millville, W. Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	640	1.5	1,800	3.0	4,600	5.0	10,320
.6	740	1.6	1,950	3.2	5,060	5.5	11,920
.7	840	1.7	2,100	3.4	5,540	6.0	13,520
.8	940	1.8	2,260	3.6	6,050	6.5	15,120
.9	1,040	1.9	2,430	3.8	6,600	7.0	16,720
1.0	1,140	2.0	2,600	4.0	7,190	7.5	18,320
1.1	1,250	2.2	2,960	4.2	7,790	8.0	19,920
1.2	1,370	2.4	3,340	4.4	8,410	8.5	21,520
1.3	1,500	2.6	3,740	4.6	9,040	9.0	23,120
1.4	1,650	2.8	4,160	4.8	9,680		

Estimated monthly discharge of Shenandoah River at Millville, W. Va., for 1903.

[Drainage area, 2,995 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	22,160	2,100	6,351	2.12	2.44
February	9,040	2,780	5,343	1.78	1.85
March	18,640	3,540	7,403	2.47	2.85
April	19,280	3,640	7,442	2.49	2.78
May	3,540	1,800	2,343	.78	.90
June	23,760	2,260	6,802	2.27	2.53
July	9,040	1,435	3,421	1.14	1.31
August	2,600	1,090	1,615	.54	.62
September	9,040	1,250	2,251	.75	.84
October	2,780	1,090	1,476	.49	.56
November	1,140	740	988	.33	.37
December	1,650	640	962	.32	.37
The year	23,760	640	3,866	1.29	17.42

SOUTH BRANCH OF SHENANDOAH RIVER NEAR FRONT ROYAL, VA.

This stream rises in Augusta County, Va., and flows in a northeasterly direction, joining the North Branch of the Shenandoah at Riverton to form Shenandoah River. This station was established June 26, 1899, by A. P. Davis. It is located about 1 mile above the ford, which is near the Norfolk and Western Railroad station. This railroad follows the right bank of the stream. The gage is a vertical timber spiked to a large sycamore tree on the left bank about 800 feet upstream from the cable. It is read twice each day by Miss Brentie Johnson. Discharge measurements are made by means of an iron wire cable, car, and tagged wire. The cable has a span of 300 feet and is suspended over the branches of two large sycamore trees, with its right end fastened to the tree and its left end anchored in the ground. The initial point for soundings is on the main cable 0.5 foot from the tree on the left bank. The channel is straight for 600 feet above and below the station and the current is sluggish. The river may overflow the right bank, but will not overflow the railroad embankment a few feet back from the river, except at extreme flood stages. The left bank is low, liable to overflow, and is fringed with trees. The bed of the stream is composed partly of rock and partly of sand, and is liable to shift in places. Bench mark No. 1 is a headless spike on the

river side of an elm tree on the left bank, 8 feet downstream from the gage. It is 1½ feet above ground and has an elevation of 10.49 feet above the zero of the gage. Bench mark No. 2 is a nail driven horizontally in the downstream side of the stump of a large sycamore tree 270 feet downstream from the gage. It is 0.5 foot above the ground and is immediately below a blaze. Its elevation is 14.55 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by Paul and Sawyer in 1903:

August 19: Gage height, 4.90 feet; discharge, 1,065 second-feet.

Mean daily gage height, in feet, of South Branch of Shenandoah River near Front Royal, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.25	7.05	12.25	9.15	5.80	7.40	8.55	4.90	7.60	4.60	4.40	4.75
2	6.10	6.60	9.40	8.10	5.70	6.50	7.00	4.90	6.45	4.60	4.45	4.80
3	9.30	6.40	7.90	7.60	5.70	5.95	6.75	4.90	5.65	4.50	4.50	4.80
4	11.25	8.20	7.45	7.35	5.60	5.75	6.55	5.35	5.35	4.50	4.55	4.90
5	8.75	7.65	7.10	7.25	5.45	5.40	6.15	5.50	5.20	4.50	4.55	4.50
6	7.70	7.15	6.75	6.95	5.50	6.00	5.75	5.60	5.15	4.50	4.50	4.50
7	7.15	6.95	6.55	6.80	5.40	7.95	6.25	5.15	5.05	4.40	4.45	4.40
8	6.70	6.65	6.65	6.70	5.40	11.00	5.95	4.85	4.85	5.50	4.40	4.35
9	6.50	6.45	6.85	6.65	5.35	10.15	5.75	4.75	4.75	5.50	4.40	4.30
10	6.10	6.25	6.75	6.55	5.30	7.90	5.55	4.70	4.80	6.00	4.45	4.40
11	5.80	6.05	6.70	6.45	5.30	7.85	5.35	4.85	4.75	4.50	4.50	4.50
12	5.75	6.10	6.60	6.35	5.25	7.70	5.25	5.30	4.70	4.70	4.40	4.55
13	5.70	6.30	6.50	6.25	5.20	6.70	5.50	5.10	4.70	4.60	4.40	4.60
14	5.75	6.15	6.45	8.40	5.15	6.70	8.15	4.80	4.70	4.55	4.40	4.50
15	5.75	6.10	6.25	10.55	5.10	6.65	7.60	4.75	4.60	4.50	4.40	4.50
16	5.40	6.70	6.15	9.35	5.05	6.60	5.90	4.70	4.50	4.40	4.40	4.40
17	5.40	7.60	6.00	8.40	5.10	6.50	5.60	4.75	4.40	4.40	4.40	4.40
18	5.40	8.75	5.90	7.90	5.10	6.45	5.35	4.80	7.80	4.50	4.50	4.30
19	5.30	7.70	5.85	7.45	5.00	6.40	5.25	4.70	7.50	4.60	4.50	4.30
20	5.30	7.10	5.75	7.10	5.00	6.40	5.05	4.70	6.70	4.65	4.40	4.30
21	5.75	6.65	5.70	6.90	5.00	6.40	5.00	4.60	6.55	4.55	4.30	4.35
22	6.95	6.25	5.85	6.80	4.95	6.35	5.90	4.60	5.55	4.50	4.30	4.40
23	7.25	6.15	7.40	6.65	4.90	6.30	5.60	4.50	5.40	4.50	4.30	4.50
24	6.60	6.60	11.60	6.45	4.90	6.25	5.75	4.50	5.30	4.50	4.40	4.50
25	6.25	6.80	9.65	6.25	5.00	5.95	5.70	4.50	5.20	4.50	4.40	4.75
26	5.85	6.65	8.15	6.20	5.00	5.75	5.60	4.50	5.10	4.45	4.50	5.10
27	5.95	6.70	7.65	6.15	5.10	6.85	5.45	4.40	4.95	4.50	4.50	5.05
28	7.30	7.30	6.95	6.05	5.15	7.40	5.25	4.50	4.85	4.50	4.70	5.10
29	9.75	.....	6.85	6.00	5.20	8.55	4.95	4.90	4.75	4.45	4.65	5.50
30	8.60	.....	7.00	5.90	5.50	8.45	4.75	5.30	4.60	4.40	4.70	5.50
31	7.60	.....	10.65	.....	5.95	.....	4.80	5.55	.....	4.40	.....	5.20

Rating table for South Branch of Shenandoah River near Front Royal, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.0	360	6.4	3,100	10.0	9,580	16.0	20,380
4.2	470	6.6	3,460	10.5	10,480	16.5	21,280
4.4	605	6.8	3,820	11.0	11,380	17.0	22,180
4.6	750	7.0	4,180	11.5	12,280	17.5	23,080
4.8	915	7.2	4,540	12.0	13,180	18.0	23,980
5.0	1,100	7.4	4,900	12.5	14,080	18.5	24,880
5.2	1,300	7.6	5,260	13.0	14,980	19.0	25,780
5.4	1,520	7.8	5,620	13.5	15,880	19.5	26,680
5.6	1,760	8.0	5,980	14.0	16,780	20.0	27,580
5.8	2,050	8.5	6,880	14.5	17,680		
6.0	2,380	9.0	7,780	15.0	18,580		
6.2	2,740	9.5	8,680	15.5	19,480		

Estimated monthly discharge of South Branch of Shenandoah River near Front Royal, Va., for 1903.

[Drainage area, 1,569 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	11,830	1,410	3,729	2.38	2.74
February	7,330	2,470	3,859	2.46	2.56
March	13,630	1,900	4,780	3.05	3.52
April	10,570	2,210	4,459	2.84	3.17
May	2,305	1,005	1,389	.89	1.03
June	11,380	1,520	4,203	2.68	2.99
July	6,970	872	2,325	1.48	1.71
August	1,760	605	1,001	.64	.74
September	5,620	605	1,735	1.11	1.24
October	2,380	605	799	.51	.59
November	830	535	646	.41	.46
December	1,640	535	813	.52	.60
The year	13,630	535	2,478	1.58	21.35

NORTH BRANCH OF SHENANDOAH RIVER NEAR RIVERTON, VA.

This stream rises in Rockingham County, Va., and flows in a northeasterly direction, joining with the South Branch of the Shenandoah at Riverton, Va. This station was established June 26, 1899, by A. P. Davis. It is located about 2 miles above Riverton, Va., a short distance from the Southern Railway station. It is most easily reached by driving from Front Royal, Va. The vertical gage rod is spiked to timber and to a sycamore tree on the left bank about 100 feet above the cable station. It is read twice each day by L. W. Burke. The original gage was a vertical timber bolted to a large sycamore tree on the right bank. On September 10, 1900, the gage was moved to the left bank and its datum was lowered 1 foot, causing all readings to be increased by 1 foot. The gage at this station washed out in the flood of February 22, 1902, and the station was temporarily abandoned until August 17, 1902, when it was reestablished by Mr. Paul, the zero of the new gage being at the same elevation as the zero of the former gage. Discharge measurements are made by means of a cable, car, and tagged wire just above the ford. The cable has a span of 260 feet, is supported by timbers, and anchored in the ground at each end. The initial point for soundings is 0.5 foot from the timber which supports the tag wire on the left bank. The channel is straight for 600 feet above and below the station. The current has a moderate velocity. Both banks are low and liable to overflow, with a fringe of trees along each bank. The bed of the stream is rocky, permanent, and free from vegetation. There is but one channel at all stages. Bench mark No. 1 is a wire nail on the river side of a pear tree near the ground. It is near the fence and 150 feet from the left bank of the river. Its elevation above the zero of the gage is 26.75 feet. Bench mark No. 2 consists of three wire nails driven flush in the surface of a stump 50 feet downstream from the fence line of the road, at the edge of the field, on the side toward the river. Its elevation is 20.44 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by W. C. Sawyer in 1903:

August 21: Gage height, 4.40 feet; discharge, 388 second-feet.

Mean daily gage height, in feet, of North Branch of Shenandoah River near Riverton, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	.....	9.00	7.15	5.10	9.05	6.30	4.45	4.30	4.30	4.30	4.75
2	4.80	.....	7.20	6.80	5.00	6.75	5.75	4.50	4.60	4.30	4.25	4.40
3	10.90	.....	6.50	6.40	5.00	5.95	5.40	4.45	4.60	4.30	4.20	4.30
4	8.95	.....	6.10	6.25	4.95	5.45	5.25	4.60	4.40	4.40	4.30	4.30
5	7.15	.....	5.80	6.05	4.80	5.15	5.60	5.20	4.40	4.25	4.25	4.30
6	6.45	.....	5.60	5.75	4.85	6.20	6.45	4.85	4.40	4.30	4.20	4.30
7	6.05	.....	5.65	5.60	4.85	8.40	5.50	4.70	4.40	4.40	4.20	4.30
8	5.75	.....	5.95	5.60	4.80	9.95	5.15	4.55	4.35	4.90	4.20	4.25
9	5.40	5.40	5.95	5.80	4.75	7.50	4.95	4.50	4.30	4.95	4.20	4.20
10	5.30	5.25	5.75	5.65	4.80	[a]12.80	4.85	4.40	4.40	4.90	4.20	4.20
11	5.25	5.20	5.70	5.60	4.75	7.50	4.80	4.45	4.65	4.80	4.25	4.20
12	[b]6.30	5.20	5.60	5.40	4.70	6.75	4.90	4.45	4.60	4.55	4.20	4.30
13	[b]8.15	5.15	5.55	5.30	4.70	7.65	5.40	4.40	4.50	4.45	4.30	4.30
14	[c]7.90	5.10	5.45	9.85	4.70	7.00	6.20	4.40	4.40	4.60	4.30	4.20
15	[c]7.90	5.10	5.40	9.30	4.70	6.35	5.70	4.40	4.35	4.60	4.20	4.20
16	[c]7.90	5.35	5.25	8.80	4.65	5.90	5.20	4.40	4.30	4.50	4.20	[c]4.20
17	[c]7.90	5.70	5.20	8.00	4.60	5.55	5.00	4.50	5.00	4.50	4.25	[c]4.20
18	7.35	5.75	5.15	7.10	4.60	5.40	4.85	4.55	6.25	4.50	4.20	[c]4.20
19	5.65	5.35	5.10	6.60	4.60	5.20	4.80	4.55	5.65	4.50	4.20	[c]4.20
20	[b]6.50	5.50	5.10	6.25	4.55	5.10	4.70	4.50	5.10	4.50	4.30	[c]4.20
21	7.00	5.70	5.00	6.00	4.55	5.05	4.70	4.40	4.75	4.40	4.25	[c]4.20
22	.....	5.50	5.75	5.75	4.50	4.90	4.60	4.30	4.70	4.40	4.20	[c]4.20
23	5.60	5.40	7.70	5.65	4.50	4.90	4.60	4.30	4.60	4.40	4.20	4.50
24	5.40	5.55	10.00	5.50	4.70	4.90	4.50	4.30	4.60	4.35	4.20	4.40
25	5.25	5.95	7.80	5.45	4.95	4.85	4.50	4.30	4.60	4.30	4.20	4.35
26	5.10	6.05	6.80	5.40	4.75	5.40	4.40	4.30	4.55	4.30	4.20	[c]4.20
27	5.00	6.05	6.25	5.40	4.70	5.25	4.40	4.30	4.40	4.30	4.20	[c]4.20
28	6.80	7.65	5.95	5.30	4.80	5.95	4.40	4.20	4.30	4.30	4.20	[c]4.20
29	.....	.....	5.65	5.20	4.70	8.10	4.40	4.20	4.30	4.30	4.20	[c]4.20
30	.....	.....	6.25	5.10	4.80	7.75	4.45	4.30	4.30	4.30	4.20	[c]4.20
31	.....	.....	7.60	.....	5.40	.....	4.40	4.30	.....	4.30	.....	[c]4.20

[a] Highest, 14.30. [b] Back water. [c] Ice.

ANTIETAM CREEK NEAR SHARPSBURG, MD.

This stream rises in the western part of Maryland and flows in a southerly direction, entering the Potomac 10 miles above Harpers Ferry. Its drainage area is mostly of a hilly character and is largely cultivated. This station was established June 24, 1897, by A. P. Davis. It is located a few hundred feet below the bridge on the toll road from Sharpsburg to Keedysville, Md. There is an old dam not now in use just below the bridge. The gage is a vertical rod driven into the gravel of the stream bed and spiked to a tree on the right bank about 100 feet above the cable. It is read once each day by David Gloss, the toll gatherer. Discharge measurements are made from a steel wire cable, which is supported by the forks of sycamore trees on each bank and is anchored to timbers set in the ground. A tagged wire is suspended above the cable. The initial point for soundings is a staple in the tree on the left bank. The channel is straight for 300 feet above and below the station. It has a width at ordinary stages of about

100 feet; is shallow and unobstructed. There is a good measurable velocity. The right bank is low and liable to overflow, the left bank is high and rocky, and both are fringed with trees. The bed of the stream is composed of gravel, free from vegetation, and is permanent. There is but one channel at all stages. The bench mark is a copper bolt set in a ledge of rock on the left bank at a point about 125 feet above the cable. Its elevation is 16.34 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Antietam Creek near Sharpsburg, Md., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 13	E. C. Murphy	3.06	584
September 4	E. G. Paul	2.10	224

Mean daily gage height, in feet, of Antietam Creek near Sharpsburg, Md., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.70	3.50	4.30	3.20	2.90	2.50	3.90	2.50	2.30	2.00	1.85	1.90
2	3.90	3.20	3.80	3.10	2.90	2.40	3.00	2.50	2.20	1.95	1.90	1.90
3	4.80	3.40	3.60	3.10	2.90	2.30	2.80	2.40	2.20	1.95	1.90	1.80
4	4.50	4.10	3.90	3.20	2.80	2.30	3.00	2.40	2.10	2.00	1.90	1.90
5	4.30	3.80	4.10	3.00	2.90	2.30	3.00	2.60	2.10	1.90	1.80	1.90
6	4.30	3.50	3.80	2.90	2.80	2.35	3.80	2.60	2.05	1.90	1.80	1.85
7	4.10	3.20	4.00	3.00	2.70	2.40	2.90	2.70	2.00	1.85	1.80	1.85
8	3.80	3.20	3.80	3.20	2.70	2.45	2.80	2.50	2.10	3.00	1.85	1.85
9	3.60	3.40	3.60	3.30	2.70	2.60	2.70	2.60	2.30	2.50	1.85	1.90
10	2.80	3.30	3.50	3.10	2.60	2.40	2.70	2.60	2.20	2.20	1.85	1.90
11	2.80	4.50	3.30	3.10	2.60	2.35	3.30	2.50	2.10	2.10	1.80	1.85
12	2.70	4.70	3.20	3.10	2.50	2.50	[a] 7.90	2.50	2.10	2.10	1.90	1.80
13	2.70	4.50	3.10	3.10	2.50	2.50	6.10	2.30	2.10	2.10	1.90	1.80
14	2.60	4.00	3.00	4.50	2.40	2.45	3.70	2.30	2.20	2.00	1.90	1.90
15	2.60	3.80	3.00	5.70	2.40	2.50	3.30	2.20	2.20	2.00	1.85	2.00
16	2.70	3.70	2.90	6.70	2.40	2.40	3.00	3.60	2.10	2.10	1.85	2.30
17	2.60	3.50	2.90	5.45	2.50	2.30	3.00	3.20	3.00	2.15	1.95	2.00
18	2.60	3.20	2.80	4.60	2.40	2.40	3.20	2.40	2.40	2.05	1.90	2.00
19	2.70	3.00	2.80	4.30	2.40	2.30	3.20	2.40	2.20	2.00	1.90	1.90
20	2.90	2.80	2.70	4.00	2.40	2.50	3.00	2.30	2.20	2.10	1.90	2.60
21	3.50	2.60	2.90	3.80	2.40	2.40	3.00	2.20	2.10	2.10	1.90	2.50
22	3.90	2.50	3.00	3.60	2.40	2.30	3.00	2.20	2.00	2.10	1.95	2.00
23	3.70	2.50	3.10	3.50	2.40	2.40	2.70	2.20	1.90	2.10	1.95	1.90
24	3.50	2.30	3.50	3.40	2.60	2.30	2.70	2.20	1.90	2.10	1.95	1.90
25	3.50	2.60	3.30	3.40	2.50	2.35	2.60	2.20	1.90	2.00	2.00	1.85
26	3.60	3.00	3.20	3.30	2.50	2.30	2.60	2.30	2.00	2.00	1.80	1.90
27	4.20	4.45	3.10	3.20	2.40	2.30	2.50	2.10	2.00	2.00	1.80	1.80
28	4.40	5.75	2.90	3.10	2.40	2.30	2.50	2.00	2.00	2.00	1.90	2.00
29	4.20	.....	2.80	3.00	2.30	3.60	2.70	2.70	1.90	2.00	1.90	2.00
30	3.90	.....	4.20	3.00	3.30	3.10	2.80	2.50	1.90	1.90	1.90	1.90
31	3.50	.....	4.00	.....	2.60	.....	2.70	2.40	.....	1.90	.....	1.90

[a] Highest record 6 p. m., 10.20.

Rating table for Antietam Creek near Sharpsburg, Md., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.8	145	2.3	295	2.8	480	3.3	720
1.9	170	2.4	330	2.9	525	3.4	775
2.0	200	2.5	365	3.0	570	3.5	830
2.1	230	2.6	400	3.1	615		
2.2	260	2.7	440	3.2	665		

Tangent at 3.2 feet gage height. Differences above this point 55 per tenth.

Estimated monthly discharge of Antietam Creek near Sharpsburg, Md., for 1903.

[Drainage area, 293 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,545	400	850	2.90	3.34
February	2,065	295	847	2.89	3.01
March	1,270	440	762	2.60	3.00
April	2,590	525	906	3.09	3.45
May	720	295	402	1.37	1.58
June	885	295	354	1.21	1.35
July	3,250	365	708	2.42	2.79
August	885	200	356	1.22	1.41
September	570	170	240	.82	.91
October	570	155	224	.76	.88
November	200	145	165	.56	.62
December	400	145	188	.64	.74
The year	3,250	145	500	1.71	23.06

POTOMAC RIVER (SOUTH BRANCH) NEAR SPRINGFIELD, W. VA.

A gaging station was established at the Baltimore and Ohio Railroad bridge, 3 miles southwest of Springfield, by C. C. Babb, in April, 1894. This station was discontinued in 1896 for want of an observer. On June 26, 1899, a station was established by E. G. Paul, at the highway bridge, 1½ miles below the original station, near Grace Station. This bridge was carried away by flood in February, 1902. The present station was established August 28, 1903, by E. G. Paul,

assisted by W. C. Sawyer. It is located at the iron highway bridge, 2½ miles east of Springfield, W. Va. The bridge is in two spans of 150 feet each. During high water the river flows beneath both spans, but at low stages the stream flows beneath the left span only. There is a dam located about 2 miles above the station, and a small island above and also one below. A standard chain gage is located in the center of the left span on the downstream side of the bridge. The length from the end of the weight to the marker is 34.76 feet. The gage is read twice each day by Miss Olivia Blue. The initial point for soundings is the river face of the left abutment at the downstream side of the bridge. The channel is straight for several hundred feet above and below the station. Both banks are low and liable to overflow. The bed of the stream is of gravel. Bench mark No. 1 is a nail in a large sycamore tree, 15 feet downstream from the left approach to the bridge. The nail is in the side of the tree away from the river and about 6 feet above the ground. Its elevation is 18.80 feet above gage datum. Bench mark No. 2 is a nail in a large willow tree on the left bank of the river, about 65 feet upstream from the bridge. It is in the side of the tree away from the river and about 2½ feet above the ground. Its elevation is 14.52 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by W. C. Sawyer in 1903:

August 29: Gage height, 2.20 feet; discharge, 201 second-feet.

Mean daily gage height, in feet, of Potomac River (South Branch) near Springfield, W. Va., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.75	2.20	2.20	2.20	17		2.25	2.40	2.20	2.50
2		2.70	2.20	2.20	2.10	18		2.45	2.40	2.20	2.50
3		2.60	2.20	2.20	2.10	19		3.00	(a)	2.20	2.50
4		2.55	2.20	2.20	2.20	20		2.85	(a)	2.30	2.10
5		2.45	2.20	2.20	2.10	21		2.65	(a)	2.30	2.20
6		2.40	2.20	2.20	2.10	22		2.50	(a)	2.30	2.40
7		2.30	2.10	2.20	2.10	23		2.45	(a)	2.20	2.65
8		2.30	2.30	2.20	2.15	24		2.40	(a)	2.20	2.40
9		2.30	2.60	2.20	2.15	25		2.35	2.20	2.20	2.30
10		2.55	2.60	2.20	2.20	26		2.25	2.20	2.20	2.30
11		2.45	2.60	2.10	2.25	27		2.20	2.20	2.20	2.65
12		2.45	2.60	2.10	2.40	28	2.20	2.20	2.20	2.20	2.60
13		2.30	2.50	2.10	2.20	29	2.20	2.20	2.20	2.20	2.60
14		2.30	2.40	2.10	2.25	30	2.55	2.20	2.20	2.20	2.60
15		2.25	2.40	2.10	2.50	31	2.80		2.20		2.60
16		2.20	2.40	2.15	2.50						

a Gage reader lost key.

POTOMAC RIVER (NORTH BRANCH) AT PIEDMONT, W. VA.

This stream rises in the western part of West Virginia and flows in a northeasterly direction, forming the boundary between Maryland and West Virginia. At a point about 15 miles below Cumberland it is joined by the South Branch, forming Potomac River. This station was established June 27, 1899, by E. G. Paul. It is located at the iron highway bridge connecting Luke, Md., with Piedmont, W. Va. The Baltimore and Ohio Railroad passes under the bridge on the right bank. The standard boxed chain gage is attached to the hand rail on the lower side of the bridge in the span next to the right bank. The length of the chain from the end of the weight to the marker is 38.87 feet. The gage is read twice each day by Charles H. Beck. Discharge measurements are made from the lower chord of the two-span highway bridge from the downstream side. The initial point for soundings is the face of the pier on the right bank. The channel is straight for 1,200 feet above and 600 feet below the station. The current has a moderate velocity. The right bank is high and rocky, and will not overflow. The left bank is low and liable to overflow, but all water passes beneath the bridge. The bed of the stream is composed of gravel and cobble stones, is free from vegetation, and is permanent. The bench mark is the top of a small shoulder in the face of the sandstone ledge which forms the right abutment of the bridge. It is about 4 feet above the ground and 10 feet downstream from the bridge. The point is indicated by an arrow cut in the vertical face of the ledge. Its elevation is 20.40 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

The following discharge measurement was made by E. G. Paul in 1903:

August 31: Gage height, 2.80 feet; discharge, 208 second-feet.

Mean daily gage height, in feet, of Potomac River (North Branch) at Piedmont, W. Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.45	5.20	6.70	4.85	3.60	3.75	4.45	2.90	2.80	2.05	2.30	2.40
2	3.60	6.05	5.55	4.75	3.50	3.55	4.05	2.95	2.65	2.10	2.30	2.45
3	6.80	6.40	5.00	4.45	3.55	3.40	3.75	2.90	2.50	2.10	2.20	2.25
4	6.15	8.20	4.65	4.95	4.55	3.30	3.70	3.00	2.40	2.20	2.20	2.25
5	5.25	6.15	4.50	4.45	3.75	3.20	4.15	3.00	2.30	2.20	2.25	2.30
6	4.80	5.25	4.50	4.20	3.60	3.25	5.20	2.80	2.50	2.45	2.40	2.30
7	4.50	4.75	4.60	4.20	3.60	5.25	4.05	2.80	2.50	(a)	2.70	2.30
8	4.20	4.60	5.20	5.15	3.50	4.55	3.65	2.70	2.35	(a)	2.50	2.20
9	3.80	4.35	6.10	5.95	3.45	4.10	3.45	2.65	2.30	(a)	2.35	2.30
10	3.80	4.00	5.40	5.20	3.40	3.90	3.30	2.50	2.70	(a)	2.30	2.30
11	3.80	4.15	4.95	4.70	3.35	4.50	3.25	2.50	2.45	(a)	2.30	2.30
12	4.35	5.05	4.80	4.60	3.20	4.35	3.30	2.50	2.40	(a)	2.30	2.20
13	3.95	4.65	4.50	4.45	3.20	4.80	4.00	2.45	2.30	(a)	2.30	2.15
14	3.75	4.50	4.30	5.30	3.10	4.80	4.10	2.40	2.20	(a)	2.30	2.20
15	3.70	4.80	4.15	5.60	3.10	5.10	3.75	2.40	2.15	(a)	2.30	2.20
16	3.70	6.95	4.00	6.05	3.10	4.55	3.50	2.40	2.10	2.50	2.30	2.30
17	3.70	5.70	3.90	5.45	3.10	4.30	3.30	2.40	2.35	2.50	2.85	2.40
18	3.50	4.95	3.80	5.00	3.00	4.00	3.45	2.60	2.70	2.60	3.65	2.20
19	3.75	4.50	3.70	4.70	3.00	3.60	3.40	2.50	2.65	2.70	3.10	2.20
20	3.60	4.35	3.60	4.40	2.90	3.65	3.40	2.95	2.50	2.65	2.70	2.30
21	3.42	4.15	3.75	4.20	2.90	4.50	3.50	2.80	2.30	2.60	2.70	2.70
22	3.50	4.00	4.55	4.00	2.80	4.15	3.35	2.60	2.20	2.50	2.70	3.20
23	3.45	3.85	6.65	3.90	3.25	6.10	3.15	2.50	2.20	2.40	2.60	2.70
24	3.20	3.90	6.00	3.80	3.90	5.15	3.00	2.40	2.15	2.40	2.60	2.85
25	3.20	3.80	5.15	3.80	4.70	4.45	2.95	2.30	2.10	2.40	2.60	4.45
26	3.25	3.70	4.70	4.30	4.60	4.00	2.90	2.40	2.10	2.30	2.50	3.80
27	3.25	4.05	4.40	4.20	4.15	3.85	2.80	2.40	2.05	2.30	2.40	3.25
28	4.75	8.80	4.25	3.85	4.00	4.10	2.70	2.65	2.10	2.30	2.30	3.20
29	5.85	.....	4.05	3.70	3.80	6.65	2.65	2.55	2.00	2.30	2.40	3.20
30	7.30	.....	4.00	3.70	3.70	5.20	2.70	2.70	2.00	2.30	2.40	2.95
31	5.70	.....	4.10	.....	3.80	.....	3.00	2.80	.....	2.30	.....	2.85

a No record from October 7 to 15, inclusive. Observer absent.

Rating table for Potomac River (North Branch) at Piedmont, W. Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.9	8	2.6	152	3.3	406	4.0	860
2.0	23	2.7	180	3.4	457	4.1	945
2.1	39	2.8	210	3.5	512	4.2	1,030
2.2	57	2.9	242	3.6	571	4.3	1,115
2.3	77	3.0	277	3.7	634		
2.4	100	3.1	316	3.8	701		
2.5	125	3.2	359	3.9	776		

Tangent at 4.0 feet gage height. Differences above this point 85 per tenth. Table is approximate above 4.4 feet.

Estimated monthly discharge of Potomac River (North Branch) at Piedmont, W. Va., for 1903.

[Drainage area, 406 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	3,665	359	1,097	2.70	3.11
February	4,940	634	1,736	4.28	4.46
March	3,155	571	1,453	3.58	4.13
April	2,602	634	1,368	3.37	3.76
May	1,455	210	572	1.41	1.63
June	3,112	359	1,170	2.88	3.21
July	1,880	166	560	1.38	1.59
August	277	77	163	.40	.46
September	210	23	90	.22	.25
October	180	31	103	.25	.29
November	602	57	134	.33	.37
December	1,242	48	191	.47	.54
The year	4,940	23	720	1.77	23.80

JAMES RIVER DRAINAGE BASIN.

James River, like the Potomac, rises among mountain ridges having a general northeasterly and southwesterly trend, the tributaries flowing along narrow valleys and finally uniting to cut the mountains transversely, the waters escaping in a southeasterly direction toward the sea. The main stream is formed by the junction of Jackson aud Cowpasture rivers, both of these rising in the central part of the western border of Virginia. The river and the water powers along it are fully described by Prof. George F. Swain in his report of the Water Powers of the Middle Atlantic Watershed, pages 13–33, contained in Vol. XVI of the Tenth Census.

Records of measurements have been kept, as in previous years, at the following places:

North (of James) River at Glasgow, Va.; James River at Buchanan, Va.; James River at Holcomb Rock, Va.; James River at Cartersville, Va.; Appomattox River at Mattoax, Va.

The descriptions of the stations, together with the records for 1903, are given in the following pages:

APPOMATTOX RIVER AT MATTOAX, VA.

This station was established August 27, 1900, by E. W. Myers. It is located on the two-span deck railroad bridge at Mattoax station, 27 miles southeast of Richmond, on the road to Danville. It is equipped with a standard chain gage with inclosed scale which is attached to the inside of the guard rail of the first span from the right bank. The length of the chain from the end of the weight to the marker is 48.82 feet. The gage is read once each day by J. C. Carter. Discharge measurements are made from the downstream side of the railroad bridge to which the gage is attached. The initial point for soundings is the end of the downstream guard rail at the right bank. Distances along this rail are indicated by white paint. The channel is straight for 400 feet above and for 100 feet below the station. The current is moderately swift. The right bank is high, and is not subject to overflow. The left bank is high but overflows beneath the second span of the bridge at high water. The bed of the stream is composed of rock and sand and is clean and permanent. There is but one channel at at all stages, broken at extreme flood stages by the central pier of the bridge. The sand bottom beneath the second span is subject to change in high water. A permanent bench mark was established August 29, 1903, by B. S. Drane, consisting of a United States Geological Survey standard iron post; it is set at the northwest corner of the Mattoax passenger station, with an elevation of 48.68 feet above gage datum. Bench mark No. 2 is on the outer upstream edge of the top of the upper chord of the upstream truss, opposite the 2-foot mark on the gage scale. Its elevation is 46.60 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Appomattox River at Mattoax, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 24	B. S. Drane	20.20	8,166
March 29	E. C. Murphy	6.25	1,282
May 21	E. W. Myers	2.35	421
Do	do	2.33	405
July 25	B. S. Drane	1.50	258
Do	do	1.50	250
August 29	do	5.55	1,294
Do	do	4.62	1,002
September 26	Paul and Sawyer	1.47	292
December 3	W. C. Sawyer	1.95	315

Mean daily gage height, in feet, of Appomattox River at Mattoax, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.38	4.90	8.35	13.50	3.65	3.40	2.55	1.75	11.40	1.60	1.75	1.90
2	3.00	4.25	9.90	14.50	3.40	3.15	2.05	4.05	8.65	1.45	1.70	1.95
3	11.20	3.90	7.02	11.50	3.25	2.90	1.95	3.05	8.20	1.40	1.70	1.90
4	11.80	9.50	4.55	5.40	3.52	2.60	1.75	2.24	4.60	1.45	1.70	1.85
5	13.25	10.50	4.25	6.50	4.00	2.40	1.75	2.60	2.90	1.55	2.25	1.80
6	14.00	10.50	4.00	6.50	3.55	4.40	4.00	2.01	2.55	1.55	3.30	1.80
7	16.00	11.30	3.80	5.00	3.30	6.20	8.50	2.00	2.15	1.40	3.65	1.85
8	5.70	5.30	4.85	5.80	3.32	14.00	3.30	1.80	2.00	1.45	2.55	1.80
9	4.50	6.25	7.25	9.00	3.10	11.60	2.30	1.55	1.95	3.00	2.10	1.85
10	3.75	5.80	7.38	10.00	2.95	7.40	1.95	1.50	1.95	4.40	2.08	1.85
11	3.30	4.50	6.10	6.90	2.80	6.50	1.80	1.40	1.95	2.75	2.02	2.10
12	6.10	8.00	5.80	5.10	2.75	5.40	1.70	3.30	4.00	2.25	2.00	2.05
13	5.40	6.70	6.50	4.95	2.70	5.80	4.70	2.30	2.90	1.95	1.95	2.10
14	4.00	7.65	5.30	14.50	2.65	4.00	10.20	4.60	1.95	1.75	1.90	2.70
15	3.50	5.00	4.50	15.05	2.65	3.20	11.80	3.35	1.70	1.75	1.95	2.75
16	3.40	8.00	4.10	15.50	2.55	3.10	13.10	2.60	1.60	1.65	1.80	2.80
17	3.50	14.90	3.80	16.35	2.45	2.60	4.40	3.20	1.75	1.65	1.80	1.80
18	3.50	15.90	3.60	8.50	2.40	2.70	2.80	2.10	4.10	2.95	3.30	1.50
19	3.25	18.00	3.50	5.30	2.35	2.40	2.85	3.40	3.80	3.80	4.60	1.45
20	2.95	18.00	3.35	4.75	2.30	2.30	2.50	7.65	2.32	2.98	3.30	1.70
21	2.80	15.90	3.25	5.60	2.25	2.35	2.35	5.20	1.80	2.20	2.25	7.50
22	7.20	5.30	8.90	7.25	2.22	3.30	2.05	3.20	1.70	2.01	2.20	8.00
23	7.90	4.80	15.00	5.90	2.25	2.45	2.01	2.35	1.55	1.85	2.15	4.50
24	4.90	4.35	19.20	4.90	2.25	2.30	1.80	1.90	1.50	1.90	2.10	3.10
25	4.20	4.25	22.30	4.70	4.05	2.30	1.75	1.55	1.50	2.00	2.00	3.40
26	3.75	3.90	20.00	4.35	4.65	2.40	1.50	1.50	1.45	2.05	2.00	3.10
27	3.65	3.60	17.20	5.30	3.55	2.55	1.45	1.45	1.50	1.85	2.00	3.15
28	5.25	4.60	6.60	5.50	3.10	2.70	1.35	2.00	1.45	1.75	2.00	3.20
29	9.00	.....	5.15	4.35	4.20	4.50	1.35	6.05	1.90	1.65	1.95	3.40
30	10.00	.....	6.10	3.90	4.00	2.90	1.35	6.90	2.05	1.65	2.00	2.25
31	6.30	.....	13.50	.....	4.00	.....	1.30	9.90	.....	1.60	.....	2.50

Rating table for Appomattox River at Mattoax, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	140	4.2	875	7.8	2,288	16.5	6,675
.8	180	4.4	935	8.0	2,380	17.0	6,965
1.0	200	4.6	995	8.5	2,615	17.5	7,255
1.2	224	4.8	1,065	9.0	2,850	18.0	7,555
1.4	251	5.0	1,135	9.5	3,090	18.5	7,855
1.6	282	5.2	1,205	10.0	3,330	19.0	8,170
1.8	316	5.4	1,275	10.5	3,575	19.5	8,485
2.0	350	5.6	1,345	11.0	3,820	20.0	8,815
2.2	390	5.8	1,415	11.5	4,065	20.5	9,145
2.4	430	6.0	1,490	12.0	4,310	21.0	9,490
2.6	473	6.2	1,576	12.5	4,555	21.5	9,835
2.8	519	6.4	1,662	13.0	4,805	22.0	10,195
3.0	565	6.6	1,748	13.5	5,055	22.5	10,555
3.2	615	6.8	1,834	14.0	5,315	23.0	10,930
3.4	665	7.0	1,920	14.5	5,575	24.0	11,695
3.6	715	7.2	2,012	15.0	5,845		
3.8	765	7.4	2,104	15.5	6,115		
4.0	815	7.6	2,196	16.0	6,395		

Estimated monthly discharge of Appomattox River at Mattoax, Va., for 1903.

[Drainge area, 745 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	6,395	519	1,762	2.37	2.73
February	7,555	715	2,582	3.46	3.60
March	10,411	627	2,592	3.48	4.01
April	6,591	790	2,449	3.29	3.67
May	1,012	394	598	.80	.92
June	5,315	410	1,006	1.35	1.51
July	4,853	237	852	1.14	1.31
August	3,282	251	704	.94	1.08
September	4,016	258	681	.91	1.02
October	765	251	372	.50	.58
November	995	299	414	.56	.62
December	2,380	316	551	.74	.85
The year	10,411	237	1,214	1.63	21.90

JAMES RIVER AT CARTERSVILLE, VA.

Observations of the height of James River are made by the Weather Bureau at Lynchburg, Va., 48 miles below Buchanan and about 100 miles above Cartersville. The drainage area is given as 3,700 square miles. The gage is on the first pier of the Amherst bridge, at the foot of Ninth street, on the side facing Lynchburg, about 100 feet from the shore. The elevation is 494.7 feet above mean sea level. The highest water was about 27 feet on September 30, 1870, and the lowest—0.3 feet on September 12–15, 1895.

Gages were established on James River in 1893 by F. B. Isaacs, engineer for water power of the Chesapeake and Ohio Railway Company, at Ninemile Locks, Columbia, Scottsville, Lynchburg, Balcony Falls, Buchanan, Eagle Mountain, and Clifton Forge. Records of heights of water at these points were made twice daily from 1893 to 1897, and freshet reports were obtained for these years. The gages were not referred to any fixed datum, but the zero of each gage was set at what was considered ordinary low water in the river. During the latter part of 1899 records were resumed, excepting at Scottsville, Balcony Falls, and Eagle Mountain, where the gages have been abandoned.

At Boshers dam, 9 miles above Richmond, is a gage where the height of water is recorded twice daily, showing the supposed head on the crest of dam. This crest, however, is so irregular that the coefficient of discharge has not been ascertained. Another complication exists in the fact that water is deflected into a canal, the quantity not being known.

Observations are maintained by the Weather Bureau at Richmond, Va., the gage being at the foot of Virginia street, near Fourteenth, immediately east of the Richmond and Danville Railroad bridge. It is a standard brass Weather Bureau gage embedded in the cement buttress. The elevation of the zero is 2.8 feet.

A gaging station was established January 1, 1899, by Prof. D. C. Humphreys, and is located at the highway bridge crossing the James between Pemberton and Cartersville, one-half mile from the railroad station and 50 miles above Richmond, Va. The original wire gage was attached to a horizontal gage rod fastened to the bridge and was referred to a bench mark, the top of the lower end of the fourth floor beam from the right bank, which is 32.04 feet above the zero of the gage. This gage was verified June 23, 1899. The original wire gage was replaced by a standard chain gage installed July 24, 1903, by B. S. Drane. The length of the chain from the end of the weight to the marker is 37.98 feet. To provide for readings over 10 feet, 2 additional markers, respectively 10 and 20 feet below the first, have been placed. The gage is attached to the timbers of the second span from the right bank

on the downstream side, at the same height as the hand rail. It is read once each day by B. T. Palmore, the postmaster. Discharge measurements are made from the lower side of the old wooden 6-span highway bridge. The initial point for soundings is the right end of the downstream hand rail. Distances are marked with white paint on the rail. The channel is straight for one-third mile above the station and for 1 mile below. Both banks are high, and will overflow only at extreme flood stages. The bed of the stream is composed of rocks and sand, and is somewhat shifting. Bench mark No. 1 is a standard copper plug set in the cap stone of the right abutment at its lower end. It is inclosed by a ring of white paint and is marked by the letters "B. M. U. S. G. S. Hydro." Its elevation is 31.77 feet above gage datum. Bench mark No. 2 is a spot of white paint on the inner eyebar of the lower chord of the bridge, under the pulley end of the gage box. Its elevation is 32.93 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of James River at Cartersville, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 30	E. C. Murphy	10.00	24,378
May 22	E. W. Myers	2.42	4,753
May 23	do	2.42	4,777
July 23	B. S. Drane	1.90	3,414
September 26	Paul and Sawyer	1.78	3,264
December 4	W. C. Sawyer	1.29	2,105

Mean daily gage height, in feet, of James River at Cartersville, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	7.45	14.05	11.35	5.30	2.65	6.82	1.62	6.08	1.50	1.31	1.25
2	2.80	6.55	14.52	9.60	5.00	2.50	5.62	2.30	6.48	1.39	1.30	1.25
3	16.05	5.70	10.72	7.90	4.60	2.32	4.60	2.15	5.55	1.42	1.30	1.25
4	15.55	6.20	7.82	7.30	4.40	2.30	4.00	2.20	3.95	1.32	1.38	1.29
5	13.70	9.70	6.85	7.12	4.28	2.31	3.45	2.78	2.80	1.35	1.50	1.20
6	9.70	11.95	5.88	6.92	4.15	6.00	4.00	2.18	2.40	1.38	1.65	1.23
7	7.80	9.02	5.85	6.30	4.05	17.78	3.48	2.25	2.08	1.50	1.82	1.25
8	6.70	7.00	7.15	6.78	3.90	18.00	4.42	2.25	1.82	1.50	1.58	1.25
9	5.68	6.52	8.12	6.78	3.62	11.80	3.30	1.82	1.70	4.30	1.50	1.23
10	4.88	5.75	7.82	7.32	3.30	7.80	2.82	1.68	1.68	3.40	1.42	1.35
11	4.82	5.05	7.70	7.40	3.28	6.35	2.62	1.52	1.90	2.25	1.48	1.25
12	4.70	7.20	7.82	7.78	3.20	7.85	3.15	1.78	2.20	2.10	1.40	1.20
13	4.20	7.50	7.85	6.92	3.10	6.80	4.00	1.75	1.90	1.92	1.38	1.35
14	4.00	7.30	7.60	11.22	3.03	5.77	6.25	3.40	1.68	1.78	1.32	1.65
15	3.60	6.20	6.90	9.22	3.00	4.30	5.15	2.20	1.65	1.62	1.35	1.58
16	3.60	7.80	6.60	8.90	2.90	4.00	4.60	1.98	1.48	1.50	1.30	1.40
17	3.60	16.85	5.95	7.65	2.80	3.50	3.82	2.35	1.52	1.45	1.30	1.25
18	3.40	17.40	5.50	6.90	2.75	4.25	3.22	1.78	6.70	2.15	1.70	1.20
19	3.30	13.20	5.08	6.28	2.70	3.15	2.69	2.58	8.42	2.00	1.78	1.15
20	3.10	9.00	4.80	7.18	2.62	2.90	2.42	3.28	4.90	1.72	1.72	1.25
21	6.45	7.50	4.82	6.78	2.50	2.85	2.22	2.25	3.65	1.65	1.65	2.05
22	7.65	7.20	10.72	5.68	2.42	2.70	2.02	2.12	2.92	1.58	1.62	2.68
23	6.15	6.30	15.50	5.48	2.40	2.72	1.92	1.68	2.50	1.52	1.50	2.25
24	5.10	5.80	18.08	5.10	2.28	3.02	1.82	1.52	2.15	1.50	1.40	1.95
25	4.80	5.55	18.70	4.85	2.90	2.70	1.73	1.40	2.00	1.38	1.40	1.85
26	4.30	5.20	12.07	4.78	2.50	4.03	1.62	1.40	1.85	1.35	1.35	1.70
27	4.10	5.00	8.83	4.95	2.75	4.52	1.52	1.45	1.70	1.32	1.30	1.80
28	7.50	6.75	7.80	7.76	4.60	4.35	1.40	5.02	1.90	1.38	1.25	1.45
29	8.60	.....	6.90	8.00	3.32	9.94	1.50	3.65	2.22	1.32	1.25	1.40
30	8.45	.....	10.37	6.80	2.98	8.10	1.42	12.12	1.65	1.30	1.23	1.55
31	8.35	.....	11.32	.....	2.90	.....	1.50	7.10	.....	1.30	.....	1.65

Rating table for James River at Cartersville, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	1,930	2.7	5,270	4.4	9,540	7.4	17,450
1.3	2,120	2.8	5,510	4.6	10,060	7.6	17,980
1.4	2,330	2.9	5,750	4.8	10,580	7.8	18,510
1.5	2,550	3.0	5,990	5.0	11,110	8.0	19,040
1.6	2,770	3.1	6,230	5.2	11,630	8.5	20,370
1.7	2,990	3.2	6,470	5.4	12,160	9.0	21,690
1.8	3,210	3.3	6,710	5.6	12,680	10.0	24,340
1.9	3,430	3.4	6,960	5.8	13,210	11.0	26,990
2.0	3,650	3.5	7,210	6.0	13,740	12.0	29,640
2.1	3,870	3.6	7,460	6.2	14,270	13.0	32,290
2.2	4,100	3.7	7,720	6.4	14,800	14.0	34,940
2.3	4,330	3.8	7,980	6.6	15,330	15.0	37,590
2.4	4,560	3.9	8,240	6.8	15,860	16.0	40,240
2.5	4,790	4.0	8,500	7.0	16,390	17.0	42,890
2.6	5,030	4.2	9,020	7.2	16,920	18.0	45,540

Above 10.0 feet gage-height table is approximate.

Estimated monthly discharge of James River at Cartersville, Va., for 1903.

[Drainage area, 6,232 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	40,372	5,510	14,607	2.34	2.70
February	43,950	11,110	18,911	3.03	3.16
March	47,400	10,580	21,744	3.49	4.02
April	27,920	10,580	17,016	2.73	3.05
May	11,900	4,330	6,870	1.10	1.27
June	45,540	4,330	12,737	2.04	2.28
July	15,860	2,330	6,592	1.06	1.22
August	29,905	2,330	5,432	.87	1.00
September	20,100	2,550	6,136	.98	1.09
October	9,280	2,120	3,047	.49	.56
November	3,210	2,025	2,442	.39	.44
December	5,270	1,850	2,550	.41	.47
The year	47,400	1,850	9,840	1.58	21.26

JAMES RIVER AT HOLCOMB ROCK, VA.

This station was established by the Willson Aluminum Company, of Holcomb Rock, Va., in 1899, in connection with measurements to determine the horsepower available at that point. During 1899 the records were fragmentary, but at the commencement of 1900 daily records were taken, which have been furnished to the Geological Survey through the courtesy of George O. Seward, general manager of the company. The gage consists of a copper float 8 by 8 by 8 inches, with a vertical rod 1½ inches square attached to it, the rod, which extends up through the power-house floor, being scaled to tenths of a foot. The copper float is inclosed in a 12-inch by 12-inch by 12-foot box, which rests solidly on the bottom of the river. The box is perforated, so that the water in it will always stand at the same level as the water in the river, while the float, being inclosed, is not in danger of being broken by floating timber. The fluctuations of the river are read directly from the rod, which moves up or down with the float as it responds to the variations in the height of the river. Measurements of discharge are not made at this point.

Mean daily gage height, in feet, of James River at Holcomb Rock, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.55	11.50	6.85	3.80	1.65	4.05	.....	3.50	1.35	0.75	1.00
2	.....	3.80	9.45	5.60	3.30	1.65	3.20	.....	2.40	1.30	1.20	1.00
3	.....	3.65	7.50	4.95	3.20	1.60	2.65	.....	2.35	1.30	1.20	1.10
4	.....	4.60	5.50	5.25	3.00	1.60	2.20	.....	1.75	1.25	1.20	1.15
5	6.85	9.60	4.50	5.05	2.85	1.75	3.10	.....	1.65	1.40	1.40	.95
6	5.40	6.70	4.30	4.70	2.70	2.25	4.25	.....	1.45	1.30	1.40	1.00
7	4.45	5.00	3.70	4.25	2.55	13.40	2.30	.....	1.60	1.35	1.30	1.10
8	3.75	4.10	3.80	4.40	2.50	8.00	2.10	.....	1.55	2.05	1.00	1.15
9	3.20	3.55	5.05	5.15	2.35	5.30	2.10	.....	1.65	2.00	1.30	1.30
10	2.55	3.20	5.75	5.50	2.25	3.80	1.95	.....	1.80	1.65	1.20	1.20
11	2.55	3.15	5.40	4.55	2.20	4.00	2.40	.....	1.70	1.50	1.20	1.15
12	2.35	5.15	5.85	4.15	2.15	4.10	.....	.....	1.45	1.50	1.20	1.25
13	2.25	5.20	5.75	4.10	2.05	3.20	.....	.....	1.35	1.45	1.25	.90
14	2.05	4.40	5.45	5.50	1.95	2.75	.....	.....	1.40	1.35	1.25	1.10
15	2.20	4.10	5.00	5.60	1.90	2.55	.....	.....	1.35	1.35	1.00	1.25
16	2.15	4.50	4.65	5.15	1.90	2.30	.....	1.40	1.35	1.30	1.25	1.25
17	2.00	12.55	3.95	4.80	2.00	2.15	.....	1.50	7.70	1.30	1.20	1.05
18	1.80	10.55	3.55	4.25	2.10	2.05	.....	1.40	7.55	1.30	1.20	1.00
19	1.90	6.75	3.25	3.80	2.10	1.90	.....	1.50	4.10	1.30	1.30	1.25
20	1.80	5.30	3.15	3.60	1.80	1.75	.....	1.30	3.05	1.40	1.30	1.30
21	2.70	4.05	4.15	3.60	1.75	1.80	.....	1.50	2.40	1.35	1.30	1.50
22	2.90	2.90	5.20	3.40	1.70	1.70	.....	1.40	2.05	1.30	1.05	1.45
23	2.70	2.60	9.55	3.20	1.70	1.80	.....	1.25	1.85	1.30	1.30	1.30
24	2.50	2.45	16.25	3.20	1.65	1.85	.....	1.45	1.80	1.30	1.25	1.20
25	2.35	2.15	9.25	3.10	1.75	1.95	.....	1.35	1.60	1.25	1.25	1.15
26	2.30	1.95	6.80	3.00	1.80	2.30	.....	1.25	1.55	1.25	1.15	1.05
27	2.15	1.70	5.50	7.50	1.70	5.00	.....	1.70	1.30	1.20	1.15	1.15
28	4.90	3.95	5.25	6.25	1.80	6.25	.....	1.20	1.30	1.20	1.00	1.50
29	6.30	.....	4.00	5.00	1.80	6.20	.....	1.35	1.35	1.20	1.00	1.60
30	6.45	.....	5.65	4.10	1.80	5.75	.....	1.75	1.35	1.20	1.00	1.55
31	5.70	.....	8.45	.....	1.70	.....	.....	1.85	.....	1.20	.....	1.20

NORTH (OF JAMES) RIVER NEAR GLASGOW, VA.

This river rises on the western slope of the Shenandoah Mountains and flows in a southeasterly direction across the valley between the Shenandoah and Blue Ridge ranges, emptying into James River about 17 miles south of Lexington, Va. Its drainage basin is largely under cultivation, except in the upper part, where it is mountainous and covered with forest growth. This station was established August 21, 1895, by C. C. Babb, assisted by D. C. Humphreys. It is located at the county bridge, three-fourths of a mile from the post-office at Glasgow, Va., and 1 mile above the mouth of North River. The original gage was of the wire type and was located on the bridge on July 22, 1903. A vertical 2 by 6 inch rod gage is nailed to a 3 by 6 inch oak timber, which is sunk to a firm foundation and securely nailed and braced to an overhanging tree on the right bank below the bridge. This gage was established on the same datum as the original wire gage and was read from the bridge. On November 24, 1903, a standard chain gage was established on the lower side of the bridge in the right span. Its datum is the same as that of the wire gage and rod gage, which it replaces. It is read once each day by B. G. Baldwin. The length of the chain from the marker to the end of the weight is 28 feet. Discharge measurements are made from the lower side of the bridge to which the gage is attached. The initial point for soundings is the center of the end pin of the downstream truss on the left bank. Originally measurements were made from the sidewalk on the upstream side of the bridge, at which point there is a good section. Beginning with 1902, measurements were made from the lower side of the bridge on account of the removal of the sidewalk. The section on the lower side of the bridge is not as favorable for accurate measurements on account of sunken logs and on account of the bridge piers. The channel is straight for 600 feet above and below the station and has a width of 240 feet, broken by 2 iron piers. Both banks are high, fringed with trees, and not liable to overflow, except at very high water. The bed of the stream is rocky near the right bank and is composed of rocks and mud near the left. Bench mark No. 1 is a standard copper plug set in the downstream end of the capstone of the right abutment. It is inclosed in a ring of white paint and is marked by the letters "B. M. U. S. G. S. Hydro." Its elevation is 23.89 feet above gage datum. Bench mark No. 2 is the upper surface of the upper chord over the pulley of the chain gage. Its elevation is 32.28 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of North (of James) River near Glasgow, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 20	E. C. Murphy	1.88	1,118
July 22	B. S. Drane	.86	394
September 19	Paul and Sawyer	2.00	1,355
November 25	W. C. Sawyer	.64	274

Mean daily gage height, in feet, of North (of James) River near Glasgow, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.30	2.65	3.85	3.50	1.80	1.02	2.40	1.10	2.00	0.75	0.70	0.60
2	1.30	2.50	3.45	2.09	1.75	1.00	1.90	1.00	1.50	.75	.70	.60
3	7.25	2.30	3.15	2.08	1.70	1.00	1.40	.90	1.40	.75	.70	.60
4	4.20	3.55	2.75	3.04	1.65	.98	1.40	.90	1.10	.78	.70	.60
5	3.35	4.80	2.65	3.00	1.58	1.10	.....	.85	1.05	.75	.90	.60
6	3.20	3.30	2.45	2.75	1.50	2.50	2.70	.90	1.00	.75	.85	.60
7	2.30	2.90	2.35	2.50	1.45	4.10	2.00	.85	1.00	.72	.80	.65
8	2.12	2.55	2.35	2.50	1.40	4.00	1.50	.80	.90	1.75	.75	.60
9	2.08	2.40	3.30	3.20	1.38	3.00	1.40	.75	.85	1.72	.75	.60
10	1.90	2.20	3.30	2.90	1.35	2.20	1.22	.75	.80	1.50	.72	.60
11	1.85	2.10	3.00	2.65	1.32	2.45	1.50	.72	.75	1.10	.72	.60
12	1.70	3.30	3.30	2.55	1.25	2.30	1.45	.70	.70	.90	.72	.60
13	1.68	3.00	3.10	2.65	1.20	2.00	1.40	.70	.70	.85	.72	.62
14	1.65	2.65	2.75	3.65	1.18	1.90	2.00	.68	.65	.80	.72	.70
15	1.60	2.50	2.65	3.50	1.16	1.75	1.72	.65	.60	.78	.72	.70
16	1.55	3.50	2.50	3.25	1.15	1.62	1.50	.80	.60	.75	.72	.65
17	1.50	10.00	2.30	3.00	1.15	1.55	1.35	.95	5.00	.75	.72	.65
18	1.45	4.50	2.20	2.75	1.12	1.20	1.25	.85	3.50	1.00	.80	.65
19	1.40	3.50	2.10	2.50	1.10	1.18	1.20	.80	2.35	.88	.75	.65
20	1.42	3.05	2.00	2.42	1.08	1.15	1.15	.75	1.65	.80	.75	.65
21	2.10	2.80	2.50	2.40	1.06	1.12	1.10	.70	1.50	.80	.72	1.50
22	2.40	2.60	3.60	2.35	1.05	1.10	1.05	.65	1.25	.80	.70	1.00
23	2.20	2.45	4.70	2.10	1.02	1.30	.90	.60	1.10	.80	.70	.95
24	2.00	2.40	6.40	2.05	1.02	1.12	.85	.60	1.00	.80	.80	.90
25	1.95	2.35	4.25	2.00	1.00	1.10	.85	.58	.95	.80	.60	.90
26	1.95	2.30	3.30	2.10	1.20	1.10	.80	.55	.90	.80	.60	.90
27	1.90	2.20	3.00	2.30	1.12	2.12	.80	.55	.85	.75	.60	.85
28	4.80	5.65	3.32	2.15	1.10	.....	.75	.50	.80	.72	.60	.85
29	4.00	.....	2.00	2.00	1.05	3.70	.70	.50	.80	.70	.55	.85
30	3.50	.....	3.20	1.90	1.03	3.20	.75	2.50	.78	.70	.60	.85
31	3.00	.....	4.20	.....	1.02	.....	.90	1.50	.....	.70	.....	.70

Rating table for North (of James) River near Glasgow, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	200	1.8	1,105	3.2	2,800	5.8	7,750
.6	250	1.9	1,200	3.4	3,110	6.0	8,150
.7	300	2.0	1,295	3.6	3,430	6.2	8,550
.8	355	2.1	1,395	3.8	3,780	6.4	8,950
.9	415	2.2	1,500	4.0	4,150	6.6	9,350
1.0	480	2.3	1,610	4.2	4,550	6.8	9,750
1.1	545	2.4	1,725	4.4	4,950	7.0	10,150
1.2	615	2.5	1,845	4.6	5,350	8.0	12,150
1.3	685	2.6	1,970	4.8	5,750	9.0	14,150
1.4	760	2.7	2,100	5.0	6,150	10.0	16,150
1.5	840	2.8	2,230	5.2	6,550		
1.6	925	2.9	2,365	5.4	6,950		
1.7	1,015	3.0	2,505	5.6	7,350		

Estimated monthly discharge of North (of James) River near Glasgow, Va., for 1903.

[Drainage area, 831 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	10,650	685	2,013	2.42	2.79
February	16,150	1,395	3,076	3.70	3.85
March	8,950	1,295	2,788	3.35	3.86
April	3,515	1,200	2,014	2.42	2.70
May	1,105	493	664	.80	.92
June	4,350	467	1,371	1.65	1.84
July	1,725	300	770	.93	1.07
August	1,845	200	395	.48	.55
September	6,150	250	821	.99	1.10
October	1,060	300	413	.50	.58
November	415	225	308	.37	.41
December	840	250	330	.40	.46
The year	16,150	200	1,247	1.50	20.13

JAMES RIVER AT BUCHANAN, VA.

This station was established August 18, 1895, by C. C. Babb, assisted by D. C. Humphreys. It is located at the iron highway bridge near the Chesapeake and Ohio Railway station, and one-half mile from the Norfolk and Western Railway station. It is about 20 miles above the mouth of North River and one-half mile above the mouth of Purgatory Creek. The United States Weather Bureau maintained a gage at this point for about two years before measurements were made by the Geological Survey. On April 3, 1897, the datum of the original wire gage was lowered 2 feet to avoid negative readings. On November 21, 1903, the wire gage was replaced by a standard chain gage installed by W. C. Sawyer. It is located on the upstream side of the bridge near the center of the left span. The length of the chain from the end of the weight to the marker is 35 feet. It is read twice each day by U. H. Hyde, a furniture dealer at Buchanan, Va. Discharge measurements are made from the lower side of the two-span iron highway bridge, which has a total span of 350 feet. The initial point for soundings is the end of pin on the lower side of bridge at the left bank. The channel is straight for 800 feet above and for about the same distance below the station. The current has a moderate velocity and is broken by the middle pier of the two-span bridge. Both banks are high, not liable to overflow, and without trees. The bed of the stream is rocky and free from vegetation. Bench mark No. 1 is the top of the upper end of the third floor beam from the left bank. Its elevation is 30 feet above gage datum. Bench mark No. 2 is the top of a stone post under the southwest corner of the porch of the Chesapeake and Ohio Railway station. Its elevation is 24.68 feet above gage datum. Bench mark No. 3 is a copper bolt in a ledge of rock on the left bank 500 feet above the station. Its elevation is 16.23 feet above gage datum. This bench mark was established November 21, 1903, at which time the old bench mark on this ledge could not be found. Bench mark No. 4 is the top of the upper end of the seventh floor beam from the left bank. Its elevation is 29.99 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of James River at Buchanan, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 20	E. C. Murphy	3.79	2,728
September 22	Paul & Sawyer	2.95	1,583
November 21	W. C. Sawyer	2.25	652

Mean daily gage height, in feet, of James River at Buchanan, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1	2.90	5.20	11.35	6.45	4.55	2.70	4.60	3.15	3.40	2.20	2.10	2.15
2	2.85	4.75	7.35	5.60	4.25	2.60	4.05	3.25	3.10	2.20	2.10	2.15
3	10.75	4.70	6.00	5.15	4.05	2.60	3.60	3.10	2.75	2.20	2.10	2.15
4	8.75	6.45	5.30	5.15	4.00	2.60	3.45	3.00	2.60	2.20	2.10	2.15
5	6.85	8.60	4.85	5.50	3.90	2.85	3.45	3.45	2.50	2.20	2.00	2.15
6	5.75	6.60	4.55	4.95	3.80	3.65	4.00	3.05	2.40	2.20	2.00	2.15
7	5.10	5.35	4.35	4.70	3.70	7.05	3.55	2.95	2.30	2.30	2.00	2.15
8	4.70	4.90	4.35	4.95	3.70	7.10	3.25	2.75	2.20	3.70	2.00	2.15
9	4.20	4.60	5.35	5.65	3.60	5.10	3.05	2.60	2.95	2.80	2.00	2.15
10	3.75	4.25	5.85	5.70	3.50	4.30	2.90	2.50	3.10	2.80	2.00	2.15
11	3.70	4.30	5.55	5.20	3.35	4.80	3.15	2.50	2.75	2.70	2.00	2.15
12	3.75	6.10	5.95	4.80	3.20	4.75	3.05	2.40	2.55	2.60	2.00	2.15
13	3.40	5.65	5.85	4.55	3.20	4.10	4.05	2.40	2.40	2.50	2.00	2.10
14	3.20	5.10	5.50	5.25	3.10	3.75	5.90	2.40	2.40	2.40	2.00	2.10
15	3.40	4.70	5.15	5.50	3.00	3.45	4.50	2.40	2.30	2.30	2.00	2.10
16	3.50	5.30	4.80	5.20	3.00	3.30	3.95	2.50	2.30	2.30	2.00	2.10
17	3.30	14.80	4.45	5.05	2.90	3.15	3.55	2.50	7.70	2.20	2.00	2.05
18	3.30	9.00	4.25	4.85	2.90	3.00	3.25	2.50	6.50	2.20	2.10	2.05
19	3.30	6.60	4.05	4.45	2.90	2.90	3.05	2.50	4.35	2.20	2.10	2.05
20	3.20	5.70	3.90	4.20	2.80	2.80	2.90	2.50	3.80	2.20	2.10	2.15
21	3.30	5.15	3.85	4.20	2.80	2.80	2.80	2.50	3.30	2.20	2.20	2.30
22	3.50	4.85	4.25	4.30	2.80	2.70	2.70	2.40	2.95	2.20	2.20	2.30
23	3.70	4.55	11.15	4.20	2.70	3.45	2.60	2.40	2.80	2.20	2.20	2.25
24	3.65	4.35	15.10	4.05	2.70	3.70	2.60	2.40	2.65	2.20	2.20	2.25
25	3.50	4.30	8.25	3.90	2.70	3.20	2.50	2.40	2.50	2.20	2.20	2.25
26	3.45	4.25	6.50	4.35	2.70	3.35	2.50	2.30	2.40	2.20	2.20	2.25
27	3.45	4.20	5.60	9.10	2.70	6.95	2.40	2.30	2.30	2.20	2.15	2.25
28	4.80	7.95	5.10	6.45	2.70	5.55	2.40	2.30	2.30	2.20	2.15	2.30
29	6.85	.....	4.75	5.40	2.70	5.60	2.40	2.20	2.30	2.10	2.15	2.30
30	6.60	.....	5.95	4.90	2.70	5.05	3.60	2.30	2.30	2.10	2.15	2.30
31	6.20	.....	8.05	.....	2.70	.....	3.35	2.40	.....	2.10	.....	2.35

Rating table for James River at Buchanan, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	410	3.1	1,750	4.2	3,450	5.3	5,720
2.1	500	3.2	1,890	4.3	3,640	5.4	5,950
2.2	600	3.3	2,030	4.4	3,830	5.5	6,180
2.3	710	3.4	2,170	4.5	4,030	5.6	6,420
2.4	830	3.5	2,310	4.6	4,230	5.7	6,660
2.5	960	3.6	2,450	4.7	4,430	5.8	6,900
2.6	1,090	3.7	2,600	4.8	4,630	5.9	7,150
2.7	1,220	3.8	2,750	4.9	4,840	6.0	7,400
2.8	1,350	3.9	2,910	5.0	5,050	6.1	7,650
2.9	1,480	4.0	3,080	5.1	5,270	6.2	7,910
3.0	1,610	4.1	3,260	5.2	5,490		

Tangent at 6.1 feet gage height. Differences above this point 260 per tenth. Table is approximate above 6.0 feet gage height.

Estimated monthly discharge of James River at Buchanan, Va., for 1903.

[Drainage area, 2,058 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	19,740	1,890	4,468	2.17	2.50
February	30,270	3,450	7,141	3.47	3.61
March	31,050	2,830	7,781	3.78	4.36
April	15,450	2,910	5,447	2.65	2.96
May	4,130	1,220	1,931	.94	1.08
June	10,250	1,090	3,416	1.66	1.85
July	4,230	830	2,116	1.03	1.19
August	2,240	600	1,083	.53	.61
September	11,810	600	1,859	.90	1.00
October	2,600	500	769	.37	.43
November	600	410	488	.24	.27
December	770	455	582	.28	.32
The year	31,050	410	3,090	1.50	20.18

ST. LAWRENCE RIVER DRAINAGE BASIN.

Lake Champlain drains an area of 7,750 square miles. Of this area, the 4,560 square miles in the State of Vermont drains through four principal streams besides many smaller ones. These four, in order

from north to south, are the Missisquoi, Lamoille, and Winooski rivers, and Otter Creek.

Missisquoi River has a total drainage area of 860 square miles, of which 245 square miles lie in Canada. It has its headwaters in the highlands west of Lake Memphremagog, thence flows southerly through Canada and westerly through Vermont into Lake Champlain. The slopes as a rule are quite steep. The basin is very generally made up of farm lands, but considerable areas of forest are found at the headwaters of all its tributaries. There is no great amount of lake or artificial storage. At many points water power is in use, but the storage at such power plants is invariably small.

Lamoille River drains a total area of 725 square miles. Its headwaters lie in the Green Mountain region in the northern part of Vermont; thence it flows in a general westerly direction into Lake Champlain. The basin includes considerable farm land, but extensive areas of forest occur at the headwaters, especially in the mountainous regions. As the slopes are steep, there is no great amount of natural or artificial storage. Water power is used at many points along the river.

Winooski River drains a total area of 995 square miles, all in Vermont. It has its headwaters in the Green Mountain district in the east-central part of the State; thence it flows generally northwesterly into Lake Champlain, near Burlington. The basin is generally in farm lands with considerable areas of forest in the headwaters. The storage, either natural or artificial, is insignificant.

Otter Creek drains a total area of 925 square miles, all in Vermont. Its headwaters are in the southern part of the State, generally at a lower elevation than those of either of the three rivers mentioned above. It flows generally northerly through some of the best farm districts in Vermont. The slope of the river between Rutland and Middlebury is very small, while between Middlebury and the mouth it is greater. The slopes of the tributary streams are generally steep. Storage in the basin is insignificant. Considerable areas on the headwaters of the river are in forest.

The following is a list of the stations in the St. Lawrence River drainage basin:

Richelieu River at Fort Montgomery, N. Y.
Missisquoi River at Swanton, Vt.
Lamoille River at West Milton, Vt.
Winooski River at Winooski, Vt.
Winooski River at Richmond, Vt.
Otter Creek at Middlebury, Vt.
Saranac River near Plattsburg, N. Y.
Saranac River near Saranac Lake, N. Y.
Racquette River at Massena Springs, N. Y.
Oswegatchie River near Ogdensburg, N. Y.

RICHELIEU RIVER AT FORT MONTGOMERY, N. Y.

Richelieu River, the outlet of Lake Champlain, leaves the lake at Rouse Point near the international boundary between New York and Canada. A record of the daily stage of the lake at its outlet has been kept since January 1, 1875. Data for reducing the observed elevation of water surface to equivalent discharge in the outlet was obtained by the United States Board of Engineers on Deep Waterways at the Chambly dam in 1898. Through the courtesy of Capt. Harry Taylor, U. S. Army, the gage readings taken daily are reported each week to the United States Geological Survey.

The gage readings are taken by measuring with a rod the depth of water on the base of the scarp wall of the north bastion of Fort Montgomery about 3 feet from the angle with the east curtain of the fort. The elevation of this datum is 95 feet above tide. The gage readings are referred to a datum 1.5 feet lower, 1.5 feet being added to the measured depth to obtain the recorded gage height. The gage zero elevation, 93.50 above mean tide at New York, is the lowest recorded stage of the lake. During winter, when the lake is frozen over, the gage height is measured in an open well, which does not freeze, situated within the fort inclosure.

The table of the maximum and minimum stage of the Richelieu River at St. Johns, Quebec, from the report of the United States Deep Waterways Commission for 1896, furnishes data for an estimate of the discharge previous to the time at which records were begun at Fort Montgomery. The datum of the St. Johns records has been connected with the Fort Montgomery datum by R. Steckel, C. E., geodetic engineer for Canada. The record covers a period prior to the construction of the Chambly Dam and includes the highest recorded stage of the stream. The elevation of the miter sill of Lock No. 1, to which the gage readings at St. Johns are referred, is 87.41 feet above mean sea level at New York. The maximum observed stage at St. Johns in April, 1869, was 13.87 feet. This corresponds to an elevation of 101.28 feet above sea level. The difference in elevation of the water surface at this stage is 2 feet. The maximum gage reading at St. Johns would thus correspond to an elevation of the water surface at Fort Montgomery of 103.28 feet, or to a gage reading of 9.78. The difference in elevation of the water surface between St. Johns and Fort Montgomery is stated to have been 0.38 foot when the water surface had its minimum elevation at St. Johns of 93.29 feet. This would correspond to an elevation of 93.67 at Fort Montgomery.

Maximum and minimum monthly stage of Richelieu River above upper miter sill of Lock 1, St. Johns, Quebec.[a]

Month.	1863.		1864.		1865.		1866.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
January								
February								
March								
April						11.67		10.50
May			11.33	10.67	11.50	10.67	10.50	9.67
June			10.92	8.58	10.67	9.25	10.00	9.17
July			8.75	7.83	9.33	8.67	9.25	8.42
August			7.92	7.42	8.92	7.83	8.67	8.08
September			8.00	7.17	8.00	7.25	9.75	8.25
October	9.83	8.42	8.67	7.83	8.25	6.75	9.42	9.00
November	9.33	8.42	9.75	8.58	7.25	6.50	9.83	8.83
December			10.00	9.75				9.92

Month.	1867.		1868.		1869.		1870.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
January					9.33	8.67	10.25	9.42
February					9.00	8.83	10.33	9.58
March					9.25	8.75	10.00	9.17
April			10.25	9.58	13.87	9.33	12.67	10.17
May	12.75	11.50	10.79	9.00	13.83	12.25	12.33	10.17
June	12.33	10.50	10.92	9.25	12.17	10.17	10.25	8.75
July			9.33	8.25	10.25	9.08	9.08	8.17
August			8.58	7.58	9.33	8.33	8.25	7.33
September			8.25	7.08	8.58	8.25	8.08	7.17
October			9.67	7.17	11.42	8.17	9.50	7.00
November			9.75	7.33	11.08	9.83	9.00	7.50
December			9.42	8.75	10.25	9.17	8.08	7.75

[a] Elevation of upper miter sill 87.41 above mean tide at New York.

Mean daily discharge, in second-feet,[a] of Richelieu River at Fort Montgomery, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11,290	12,520	15,310	40,240	22,900	12,520	11,800	10,100	9,250	6,700	6,700	6,530
2	11,120	12,520	17,120	43,940	23,380	11,980	11,980	10,440	9,420	6,020	6,870	6,020
3	11,290	12,700	17,610	41,720	26,700	11,460	11,800	13,980	9,420	6,190	6,700	6,020
4	11,120	13,240	18,030	40,610	21,940	11,460	11,630	10,780	9,080	7,890	6,700	6,020
5	11,120	13,240	18,240	40,240	21,480	11,290	11,630	10,780	8,910	6,870	6,020	6,190
6	11,290	13,420	18,450	40,610	20,820	11,290	11,460	11,630	8,740	6,020	6,360	6,020
7	11,290	13,420	19,500	41,350	20,380	11,460	11,460	9,930	8,570	6,870	6,700	6,020
8	11,460	13,600	18,660	39,500	20,160	11,460	11,290	10,270	8,570	7,380	6,700	5,850
9	11,290	13,600	19,940	39,500	19,500	10,780	11,120	10,610	9,080	6,530	7,210	5,850
10	11,290	13,790	20,820	38,800	19,080	10,780	11,120	9,760	9,930	6,700	7,550	5,850
11	11,290	13,790	23,140	38,450	19,080	10,440	11,120	10,270	8,060	6,530	6,870	6,020
12	11,120	13,790	25,140	37,400	18,660	10,780	11,120	9,930	8,400	6,360	6,700	6,190
13	11,120	13,980	26,700	36,700	18,660	11,120	10,950	9,760	8,910	6,360	7,380	6,020
14	11,120	14,550	28,440	36,000	18,030	11,630	10,610	10,100	8,230	6,190	6,870	6,190
15	11,290	14,740	29,020	36,000	17,400	11,630	11,460	9,760	7,890	6,530	6,530	6,190
16	11,120	14,740	29,910	33,690	17,120	11,460	10,270	9,760	8,400	7,210	6,360	6,190
17	11,120	14,930	30,220	32,700	16,830	11,800	10,440	9,760	8,400	6,700	7,210	6,020
18	11,120	14,930	30,840	31,770	16,640	11,630	10,610	9,930	7,550	6,700	6,700	5,850
19	11,120	14,930	32,080	31,460	16,260	11,460	9,930	10,100	7,380	7,210	6,530	6,020
20	11,290	14,930	32,080	31,150	16,070	11,800	10,100	9,930	7,380	7,550	6,700	6,190
21	11,120	15,120	32,700	30,530	15,690	11,980	9,930	9,930	7,380	6,870	6,870	6,190
22	11,120	14,930	34,680	29,910	14,930	12,340	10,100	10,270	7,040	7,720	6,700	6,190
23	11,290	14,740	36,700	29,020	14,550	12,700	10,100	9,930	8,060	7,040	7,040	6,700
24	11,290	14,740	39,500	28,440	14,550	12,340	10,270	9,590	6,530	7,040	6,530	6,530
25	11,120	14,550	42,090	27,570	14,170	12,700	10,440	9,760	6,700	7,550	6,360	6,530
26	11,120	14,170	43,200	26,700	14,550	12,700	10,270	9,590	7,720	6,870	6,360	6,530
27	11,460	13,980	42,830	26,180	14,550	12,160	10,270	9,760	8,570	6,700	6,360	6,700
28	11,290	14,170	43,200	25,920	13,790	11,980	10,440	9,420	6,700	6,870	6,190	6,530
29	11,630	.....	42,460	24,880	12,700	11,980	10,610	9,760	6,530	7,380	6,190	6,870
30	11,460	.....	42,460	24,620	12,880	12,160	10,610	9,530	6,700	6,870	6,190	6,700
31	12,340	.....	41,720	.....	12,700	.....	10,270	9,590	.....	6,870	.....	6,870
Mean	11,200	14,063	29,445	34,186	17,618	11,709	10,813	10,166	8,117	6,848	6,672	6,245

[a] Discharge taken from nearest 0.05 gage reading.

Estimated monthly discharge of Richelieu River at Fort Montgomery, N. Y., for 1903.

[Drainage area, 7,750 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	12,340	11,120	11,200	1.44	1.66
February	15,120	12,520	14,063	1.81	1.88
March	43,200	15,310	29,445	3.80	4.38
April	43,940	24,620	34,186	4.41	4.92
May	26,700	12,700	17,618	2.27	2.62
June	12,700	10,440	11,709	1.51	1.68
July	11,980	9,930	10,813	1.39	1.60
August	13,980	9,420	10,166	1.31	1.51
September	9,930	6,530	8,117	1.05	1.17
October	7,890	6,020	6,848	.88	1.01
November	7,550	6,020	6,672	.86	.96
December	6,870	5,850	6,245	.81	.93
The year	43,940	5,850	13,924	1.80	24.32

The following miscellaneous measurements of this stream have been made at St. Johns, Quebec:[a]

Measurements of Richelieu River at St. Johns, Quebec.

Date.	Hydrographer.	Gage height.	Elevation greater above tide.	Discharge.
		Feet.	*Feet.*	*Second-feet.*
October 16, 1862	Charles Legge[b]			4,257
September 10, 1894	Henry Holgate[c]	7.58	93.85	6,390
August 22, 1895	Cecil B. Smith	7.67	93.94	6,102
October 17, 1895	C. H. McLeod[c]	7.00	93.27	3,750

[a] Report of United States board of engineers on deep waterways, Pt. 1, page 431.
[b] Furnished by Ernest Marceau, esq., engineer of railways and canals, Montreal, Canada.
[c] Furnished by J. W. Macklin, engineer of the Chambly Power Co.

On April 28, 1899, J. W. Macklin made a weir measurement at the dam of Chambly Power Company, Chambly, Quebec:

Length of weir	feet	1,625
Depth of water on weir measured to surface of still water above	do	3.20
Reading of gage at St. Johns	do	11.75
Surface of water at St. Johns above tide	do	99.13
Discharge, as computed by Mr. Macklin (passing over weir)	second-feet	29,050
Add passing through sluice to mill	do	800
Total	do	29,850

At the time the above gaging was made there was no wind and the river had been at about the same stage for several days. This is probably near a high-water discharge.

The gagings of Messrs. Holgate and Smith were made with tubes weighted so as to float vertically and reaching nearly to the bottom with but little projecting above the water. That by Professor McLeod was made with an "Amsler mechanical meter."

MISSISQUOI RIVER AT SWANTON, VT.

This station was established March 30, 1903, by H. K. Barrows. It is located at the steel highway bridge on the road from Swanton to St. Albans, about three-eighths of a mile from East Swanton Railway station. The drainage area at this point is 850 square miles. A chain gage is attached to the downstream truss; the length of chain is 23.23 feet to the 30-feet tag. It is referred to bench marks as follows: (1) Circle cut in ledge 200 feet south of highway bridge, and about 30 feet from center of road; elevation, 50.70 feet. (2) Circle cut in top of lowest stone of north abutment of railroad bridge at east end; elevation, 54.73 feet. Elevations are above gage datum. Velocities at low stages of the river are very small. The gage was read twice daily by O. A. Skeels, of Swanton. The station was discontinued September 20, 1903, on account of the effect on the flow of water by the dam below, and the generally poor conditions for a gaging station.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Missisquoi River at Swanton, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 30	H. K. Barrows	35.00	3,235
April 11	A. D. Butterfield	34.90	3,400
April 22	do	33.85	1,225
May 1	H. K. Barrows	33.75	695
May 7	do	33.08	410
May 14	do	32.05	400
May 28	do	29.00	270

Mean daily gage height, in feet, of Missisquoi River at Swanton, Vt., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		34.65	33.75	28.75	29.65	33.85	30.28
2		34.75	33.75	28.78	29.35	33.60	29.65
3		34.60	33.75	28.95	29.48	33.20	29.32
4		38.80	33.70	29.10	30.60	32.78	29.45
5		37.20		29.00	31.50	32.20	29.35
6		35.95		28.88	31.45	31.35	28.90
7		35.45	33.00	28.75	30.50	30.92	28.72
8		36.35	33.40	28.72	29.98	30.40	28.65
9		35.70	33.12	28.38	29.60	30.60	28.85
10		35.30	33.22	28.30	29.38	29.95	28.78
11		35.05	33.05	28.45	29.35	30.40	28.85
12		34.80	33.08	28.62	28.98	32.55	28.78
13		34.50	32.62	28.85	28.75	34.02	28.78
14		34.40	32.22	29.35	28.68	33.55	28.90
15		34.25	31.48	29.92	29.05	33.30	28.80
16		34.35	30.78	29.95	29.30	33.08	28.75
17		34.55	30.82	29.55	29.32	32.40	28.72
18		34.35	30.40	29.22	29.05	31.95	28.60
19		34.20	29.92	29.12	30.50	30.48	28.45
20		34.00	29.80	29.18	30.70	31.42	28.35
21		33.90	29.62	29.30	30.40	34.25	28.38
22		33.90	29.42	31.18	29.48	33.85	28.35
23		33.85	29.68	33.95	29.22	33.75	28.30
24		33.85	29.42	33.48	29.58	33.50	28.25
25		33.75	29.35	32.62	32.25	33.00	28.18
26		33.80	28.95	31.82	34.85	32.82	28.10
27		33.70	28.90	30.62	34.70	32.78	28.40
28		33.65	29.02	30.10	34.00	32.65	28.60
29		33.75	28.92	29.65	33.60	32.15	28.45
30	35.00	33.75	28.82	29.85	33.50	31.88	[a]28.42
31	34.65		29.30		34.38	31.55	

[a] Station discontinued October 1.

LAMOILLE RIVER AT WEST MILTON, VT.

This station was established March 28, 1903, by H. K. Barrows. It is located at the steel highway bridge near West Milton post-office. The drainage area at this point is 715 square miles. The chain gage is attached to the lower chord of the upstream truss; length of chain is 25.20 feet. It is referred to bench marks as follows: (1) Cross cut in face of ledge on west bank in line of south truss; elevation, 28.35 feet. (2) South end of west pier near foot of truss; elevation, 23.42 feet. Elevations are above gage datum. The channel is straight for 1,000 feet above and 1,000 feet below the station, is about 280 feet wide at ordinary stages, and is broken by one pier. The velocities at low stages of the river are small. The station was discontinued October 8, 1903, as it was found that backwater from Lake Champlain reached this point and affected the height and flow of the water. The gage was read twice daily by Harry A. Granger, of West Milton.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Lamoille River at West Milton, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 28	H. K. Barrows	12.00	3,480
April 6	C. B. Brownell	11.55	2,762
April 23	A. D. Butterfield	9.60	795
April 29	H. K. Barrows	8.75	655
May 6	C. H. Pierce	7.93	455
May 13	do	7.32	395
May 20	do	6.72	195
May 27	do	6.10	245
June 8	do	5.45	220
June 15	E. C. Murphy	5.79	775
Do	do	5.75	763
June 26	H. K. Barrows	5.72	450

Mean daily gage height, in feet, of Lamoille River at West Milton, Vt., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	11.58	8.55	5.72	5.50	5.92	4.80	4.00
2	.....	11.50	8.40	5.68	5.50	5.55	4.80	4.00
3	.....	11.40	8.25	5.60	5.52	5.35	4.80	4.20
4	.....	12.20	8.05	5.58	5.58	5.30	4.80	4.30
5	.....	11.90	8.00	5.50	5.55	5.22	4.80	4.20
6	.....	11.55	7.92	5.48	5.50	5.20	4.75	4.15
7	.....	11.45	7.82	5.40	5.50	5.15	4.65	4.05
8	.....	11.50	7.70	5.40	5.45	5.10	4.60	4.00
9	.....	11.45	7.60	5.32	5.42	5.10	4.58	(a)
10	.....	11.35	7.50	5.30	5.40	5.00	4.50	.....
11	.....	11.25	7.45	5.28	5.55	5.00	4.50	.....
12	.....	11.10	7.35	5.40	5.60	5.80	4.50	.....
13	.....	10.92	7.28	5.70	5.35	5.40	4.50	.....
14	.....	10.80	7.18	5.95	.....	5.18	4.40	.....
15	.....	10.65	7.10	5.75	5.30	5.10	4.40	.....
16	.....	10.55	7.00	5.60	5.22	5.02	4.40	.....
17	.....	10.45	6.88	5.60	5.35	5.00	4.40	.....
18	.....	10.32	6.80	5.60	5.25	4.90	4.35	.....
19	.....	10.20	6.75	5.55	5.18	4.95	4.32	.....
20	.....	10.05	6.62	5.52	5.15	6.70	4.30	.....
21	.....	9.85	6.55	5.58	5.15	6.25	4.30	.....
22	.....	9.70	6.52	5.90	5.85	5.60	4.30	.....
23	.....	9.58	6.38	6.20	5.80	5.25	4.20	.....
24	.....	9.45	6.32	5.90	6.35	5.08	4.20	.....
25	.....	9.35	6.25	5.72	5.75	5.00	4.00	.....
26	.....	9.20	6.20	5.72	5.60	5.00	4.00	.....
27	.....	9.05	6.18	5.70	6.05	5.00	4.00	.....
28	12.00	8.88	6.08	5.65	5.62	5.00	4.00	.....
29	11.85	8.75	5.95	5.60	5.45	4.90	4.00	.....
30	11.62	8.70	5.88	5.58	5.55	4.85	4.00	.....
31	11.58	.....	5.80	.....	6.42	4.80	.....	.....

[a] Station discontinued October 9.

Rating table for Lamoille River at West Milton, Vt., from March 28 to June 11, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.3	214	6.6	296	7.9	449	10.4	1,540
5.4	218	6.7	305	8.0	466	10.6	1,725
5.5	222	6.8	314	8.2	503	10.8	1,915
5.6	226	6.9	324	8.4	544	11.0	2,125
5.7	231	7.0	334	8.6	589	11.2	2,360
5.8	237	7.1	345	8.8	639	11.4	2,605
5.9	243	7.2	356	9.0	700	11.6	2,860
6.0	250	7.3	367	9.2	775	11.8	3,135
6.1	257	7.4	379	9.4	870	12.0	3,425
6.2	264	7.5	391	9.6	975	12.2	3,715
6.3	271	7.6	404	9.8	1,090		
6.4	279	7.7	418	10.0	1,225		
6.5	287	7.8	433	10.2	1,375		

Estimated monthly discharge of Lamoille River at West Milton, Vt., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 28–31	3,425	2,860	3,088
April	3,715	613	1,819
May	577	237	354
June 1–11	231	214	221

WINOOSKI RIVER AT RICHMOND, VT.

This station was established June 25, 1903, by H. K. Barrows. It is located at the steel highway bridge about one-fourth mile from Richmond railway station on the road to Huntington. The drainage area at this point is 885 square miles. A standard chain gage is attached to the downstream truss; length of chain, 29.68 feet. It is referred to bench marks as follows: (1) On top of plate near north end of gage box; elevation, 28.76 feet. (2) Marked point on the west end of south abutment; elevation, 27.32 feet. Elevations are above gage datum. The channel is straight for 100 feet above and 100 feet below this station, and is about 175 feet wide. The bed is gravelly and permanent. The current is medium except at low water. Gagings at low stages of the river are made by wading at a point 2,500 feet upstream from bridge, where the bed is of gravel and the current swift. The banks are high and are not subject to overflow. The gage is read twice daily by George Champang, a farmer, of Richmond.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Winooski River at Richmond, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 6	H. K. Barrows	4.00	202
June 25	do	5.05	1,040
July 6	do	4.50	545
July 22	N. C. Grover	5.33	1,318
August 7	H. K. Barrows	4.23	392
August 13	do	4.40	450
Do	do	4.42	475
September 15	do	3.70	146
Do	do	3.78	154
November 11	do	4.42	452

Mean daily gage height, in feet, of Winooski River at Richmond, Vt., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.37	4.82	4.08	3.72	5.05	4.45
2	.....	4.61	4.77	4.02	3.92	4.78	4.38
3	.....	4.69	Missed.	4.05	4.02	4.65	4.48
4	.....	4.38	Missed.	3.98	3.92	4.50	4.45
5	.....	4.23	4.26	3.98	4.08	4.45	4.45
6	.....	4.46	4.34	3.98	4.22	4.52	(a)
7	.....	4.52	4.31	3.95	4.10	4.65	.....
8	.....	4.35	4.20	3.95	4.05	4.50	4.15
9	.....	4.19	4.10	3.98	4.60	4.42	.....
10	.....	4.04	4.10	3.98	5.18	4.48	.....
11	.....	4.11	4.18	3.92	4.80	4.38	4.50
12	.....	4.08	4.22	3.95	4.60	4.35	.....
13	.....	3.97	4.45	3.88	4.35	4.32	.....
14	.....	4.05	4.32	3.78	4.28	4.28	.....
15	.....	4.05	4.20	3.92	4.15	4.22	4.85
16	.....	4.12	4.02	3.92	4.05	4.12	.....
17	.....	4.29	4.05	3.85	4.08	4.38	.....
18	.....	4.24	4.05	3.92	4.08	5.40	4.90
19	.....	4.11	4.02	3.80	4.70	4.95	.....
20	.....	4.21	4.85	3.82	4.90	4.68	.....
21	.....	5.58	4.68	3.68	4.68	4.68	.....
22	.....	5.31	4.45	3.90	4.45	4.92	7.00
23	.....	6.21	4.25	3.70	4.35	4.68	.....
24	.....	5.84	4.20	3.85	4.78	4.45	.....
25	5.00	4.97	4.18	3.72	4.75	4.38	5.90
26	4.80	4.87	4.18	3.85	4.60	4.72	.....
27	4.65	4.93	4.18	3.72	4.60	4.52	.....
28	4.45	4.63	4.15	3.72	4.50	4.58	.....
29	4.42	4.53	4.10	3.78	4.45	4.60	5.90
30	4.35	4.98	3.98	3.78	4.62	4.48	.....
31	.....	5.42	4.00	.....	5.15	.....	.....

a Readings through ice December 6–31.

Rating table for Winooski River at Richmond, Vt., from June 25 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.7	139	4.4	448	5.1	1,100	5.8	1,800
3.8	164	4.5	517	5.2	1,200	5.9	1,900
3.9	195	4.6	602	5.3	1,300	6.0	2,000
4.0	232	4.7	700	5.4	1,400	6.1	2,100
4.1	277	4.8	800	5.5	1,500	6.2	2,200
4.2	330	4.9	900	5.6	1,600	6.3	2,300
4.3	387	5.0	1,000	5.7	1,700		

Estimated monthly discharge of Winooski River at Richmond, Vt.

[Drainage area, 885 square miles.]

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 25–31	1,000	417	635
July	2,210	221	668
August [a]	850	224	395
September	267	135	192
October	1,180	144	506
November	1,400	287	600
December [b] 1–5	503	436	476

[a] Gage readings for August 3 and 4 estimated.
[b] Frozen December 6–31.

WINOOSKI RIVER AT WINOOSKI, VT.

This station was established March 18, 1903, by H. K. Barrows. It is located at "High Bridge," a covered wooden highway bridge on the road from Winooski to the limekilns. The drainage area at this point is 985 square miles. A chain gage is attached to the outside of the downstream truss; length of chain, 52.15 feet to 50-foot tag. It is referred to bench marks as follows: (1) Top of marble railroad monument, 2 feet south of track and 90 feet west of road crossing; elevation, 94.17 feet. (2) Top of white marble railroad monument in center of track, middle of rock cut; elevation, 89.83 feet. (3) Marked point on southwest corner of east bridge abutment of railroad bridge No. 5; elevation, 84.75 feet. All elevations refer to the datum of the gage. Measurements of flow were made from railroad bridge located about 1 mile downstream, near the crest of the dam of the electric-light plant. This dam is 37.50 feet above the datum of the gage. As power is used here for electric lighting only, water is not used at all during daytime. At low stages of the river, however, the water level may be below the crest of the dam and water will be drawn down during the night and stored during the day; consequently, gage heights below 38 feet mean nothing as to amount of flow except that the stage of the river is low. The station was discontinued November 29, 1903, on account of the generally unsatisfactory conditions for a low-water record. The gage was read twice daily by John De Forge of Winooski.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Winooski River at Winooski, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 19	H. K. Barrows	43.25	7,450
March 31	A. D. Butterfield	40.80	4,476
April 8	do	41.30	5,510
Do	do	41.30	5,595
April 13	H. K. Barrows	39.65	2,510
April 15	A. D. Butterfield	39.50	2,415
Do	do	39.45	2,210
April 20	H. K. Barrows	39.00	1,575
April 27	A. D. Butterfield	38.70	1,165
May 9	H. K. Barrows	38.35	740
May 18	A. D. Butterfield	38.05	355

Mean daily gage height, in feet, of Winooski River at Winooski, Vt., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		41.85	38.70	37.60	38.10	38.30		34.10	39.55
2		40.70	38.60	37.60	38.30	38.10		35.30	39.70
3		40.35	38.60	37.60	38.25	37.90		37.30	39.50
4		42.35	38.40	37.70	38.00	37.90		37.20	39.50
5		40.85	38.40	37.55	38.00	37.90		37.40	39.50
6		40.60	38.40	37.50	38.00	37.90		37.80	39.45
7		40.50	38.25	37.30	38.10	37.90		38.55	39.50
8		41.10	38.30	37.30	38.15	37.80		39.00	39.40
9		41.10	38.30	36.65	38.05	37.75		39.40	39.40
10		41.10	38.30	36.50	38.00	37.45		40.10	39.40
11		40.20	38.20	37.85	38.00	37.65		40.00	39.40
12		39.85	38.25	38.85	38.00	37.80	37.50	39.75	39.30
13		39.65	38.15	39.65	37.95	37.70	37.35	39.10	39.30
14		39.50	38.10	40.05	38.10	37.55	36.45	39.10	39.10
15		39.45	38.10	40.10	38.05	37.55	35.35	38.95	39.10
16		39.50	38.10	39.45	37.95	37.50	33.55	38.75	39.10
17		39.60	38.10	38.60	37.90	37.50	33.30	38.70	39.25
18	43.00	39.30	38.10	38.50	37.90	37.55	35.45	38.95	40.30
19	43.30	39.15	38.10	38.40	37.90	37.55	35.15	39.40	40.80
20	46.40	39.05	38.05	38.40	38.00	37.80	34.50	39.75	40.70
21	46.40	38.95	38.00	38.60	38.40	37.95	34.55	39.70	40.05
22		38.90	37.95	38.90	39.30	37.50	31.50	38.90	39.60
23	44.70	38.80	37.90	38.85	39.30	37.50	33.40	38.95	39.50
24	49.70	38.75	37.90	39.00	39.30	37.55	33.75	38.90	39.35
25	47.40	38.80	37.85	38.90	39.00	37.50	34.65	38.85	39.20
26		38.70	37.75	38.50	39.00	(a)	34.10	39.30	39.10
27	41.70	38.60	37.70	38.50	39.00		33.60	39.20	39.25
28	41.40	38.65	37.70	38.50	38.85		33.75	38.95	38.80
29	41.10	38.60	37.70	38.40	38.60		34.40	38.90	(b)
30	40.55	38.65	37.70	38.20	38.30		33.90	39.20	
31	40.75		37.70		38.30			39.50	

a No record August 26 to September 11.

b Station discontinued November 29.

Rating table for Winooski River at Winooski, Vt., from March 18 to November 28, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
38.0	305	39.1	1,715	40.2	3,415	41.3	5,535
38.1	420	39.2	1,855	40.3	3,585	41.4	5,750
38.2	537	39.3	2,000	40.4	3,760	41.5	5,965
38.3	657	39.4	2,145	40.5	3,935	41.6	6,180
38.4	780	39.5	2,295	40.6	4,115	41.7	6,395
38.5	906	39.6	2,445	40.7	4,300	41.8	6,610
38.6	1,034	39.7	2,600	40.8	4,495	41.9	6,825
38.7	1,165	39.8	2,755	40.9	4,695	42.0	7,040
38.8	1,300	39.9	2,915	41.0	4,900		
38.9	1,435	40.0	3,080	41.1	5,110		
39.0	1,575	40.1	3,245	41.2	5,320		

Tangent at 41.2 feet gage height. Differences above this point 215 per tenth. Discharge under gage height 38.0 feet not applied on account of low velocity, rendering the discharge measurements uncertain, and on account of fluctuations of gage height at dam below.

Estimated monthly discharge of Winooski River at Winooski, Vt., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 18–31	23,595	4,025	11,873
April	7,792	1,034	2,871
May 1–21	1,165	305	616
June 12–30	3,245	537	1,416
July 1–15, 20–31 [a]	2,000	305	810
August 1, 2	657	420	538
September			
October 7–31	3,245	970	1,866
November 1–28	4,495	1,300	2,327

[a] 1 to 15 inclusive and 20 to 31 inclusive.

OTTER CREEK AT MIDDLEBURY, VT.

This station was established April 1, 1903, by H. K. Barrows. It is located at the railroad bridge in the village of Middlebury, above and within the influence of the dam used for power purposes. The water, however, never falls below the crest of the dam. The drainage area at this point is 615 square miles. A chain gage is attached to the downstream truss of this bridge; length of chain is 17.52 feet to the 10-foot tag. It is referred to a bench mark on top of south bolt in bridge seat on downstream side of north abutment; elevation, 20.08 feet above gage datum. Measurements are made from a boat at medium stages, and from a stone-arch highway bridge about one-half mile downstream at low stages of the river. The current at the gage is small, except at high stages of the river; at the stone-arch bridge it is medium at low stages of the river. The banks are high and not subject to overflow, and the bed is permanent. The gage is read twice daily by R. P. Bingham, of Middlebury.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Otter Creek at Middlebury, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 3	C. B. Brownell	15.90	3,730
April 18	H. K. Barrows	13.62	1,335
April 28	do	12.75	640
May 9	do	12.35	455
May 19	do	12.20	235
June 24	do	13.05	835
July 7	do	12.20	245
July 18	N. C. Grover	12.00	284
August 6	H. K. Barrows	12.25	337
September 14	do	11.71	190
November 21	do	12.48	484

Mean daily gage height, in feet, of Otter Creek at Middlebury, Vt., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.10	12.62	11.58	12.40	12.20	12.20	12.00	12.30	12.02
2	16.00	12.60	11.88	12.68	12.20	12.30	12.00	12.20	12.10
3	15.90	12.60	11.90	12.62	11.88	12.22	12.00	12.28	12.10
4	15.80	12.48	11.90	12.45	12.08	12.20	12.10	12.22	12.05
5	15.70	12.45	11.88	12.20	12.20	12.20	12.02	12.20	12.05
6	15.60	12.45	11.80	12.10	12.20	12.30	12.15	12.45	12.10
7	15.55	12.42	11.88	12.20	12.18	12.05	12.50	12.58	11.82
8	15.45	12.40	11.58	12.15	12.20	12.10	12.48	12.60	12.00
9	15.35	12.35	11.75	12.10	12.20	12.10	12.78	12.32	12.05
10	15.25	12.35	11.92	12.10	11.92	12.10	13.28	12.40	12.00
11	15.05	12.20	12.25	12.02	12.12	12.10	13.40	12.32	12.00
12	14.85	12.25	12.38	12.02	12.65	12.02	13.05	12.30	12.00
13	14.60	12.25	13.42	11.68	13.02	12.00	12.78	12.30	12.18
14	14.20	12.20	13.95	11.80	12.72	11.75	12.48	12.25	12.32
15	13.80	12.20	13.65	11.98	12.45	11.85	12.40	12.30	12.92
16	13.70	12.20	13.08	12.02	12.30	12.00	12.28	12.02	12.80
17	13.72	12.20	12.85	12.02	12.05	12.05	12.20	12.22	(a)
18	13.65	12.10	12.68	11.98	12.18	12.10	12.42	12.85	.....
19	13.52	12.20	12.50	12.05	12.15	12.10	12.80	13.08	12.60
20	13.35	12.20	12.45	11.75	12.30	12.20	13.18	12.85	.....
21	13.25	12.10	12.50	12.12	12.50	12.00	12.88	12.45	14.25
22	13.08	12.10	12.95	12.40	12.70	12.08	12.68	12.30	14.50
23	13.05	12.10	13.55	13.85	12.55	12.10	12.52	12.22	.....
24	12.90	12.12	13.10	13.52	12.22	12.08	12.70	12.32	14.10
25	12.88	11.62	12.75	12.95	12.20	12.00	12.70	12.40	.....
26	12.80	11.88	12.62	12.62	12.32	11.95	12.55	12.12	13.40
27	12.70	11.95	12.88	12.55	12.45	11.85	12.50	12.00	.....
28	12.75	11.98	12.72	12.55	12.58	11.65	12.50	12.10	12.70
29	12.70	11.95	12.45	12.32	12.38	11.80	12.40	12.28	.....
30	12.65	11.90	12.38	12.32	12.32	11.98	12.40	11.90	.....
31	.....	11.90	.....	12.25	12.10	.....	12.35	.....	12.50

a Readings through ice December 17 to 31.

Rating table for Otter Creek at Middlebury, Vt., from April 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
11.6	163	12.5	501	13.4	1,120	14.6	2,300
11.7	188	12.6	555	13.5	1,210	14.8	2,520
11.8	217	12.7	610	13.6	1,300	15.0	2,740
11.9	248	12.8	670	13.7	1,400	15.2	2,960
12.0	283	12.9	740	13.8	1,500	15.4	3,180
12.1	320	13.0	810	13.9	1,600	15.6	3,400
12.2	360	13.1	880	14.0	1,700	15.8	3,620
12.3	403	13.2	955	14.2	1,900	16.0	3,840
12.4	450	13.3	1,035	14.4	2,100		

Table well determined.

Estimated monthly discharge of Otter Creek at Middlebury, Vt., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
April	3,950	582	1,987
May	566	168	370
June	1,650	159	573
July	1,550	183	448
August	824	242	417
September	403	175	303
October	1,120	283	541
November	866	248	431
December 1-16, inclusive	754	223	356

SARANAC RIVER NEAR PLATTSBURG, N. Y.

A gaging station was established at a dam at this place March 27, 1903, by A. M. Evans. The record includes the flow over a straight spillway crest 190 feet in length, the discharge through two 5-foot waste gates when open, and through four 33-inch Victor turbines, controlled by automatic governors. Experiments have been made at Cornell University hydraulic laboratory on a model of the ogee section for computation of the discharge. The gage on the crest of the dam is a vertical 1¼ by 6 inch cypress board reading from zero to 7.5 feet. It is attached to the wing wall on the right side of the stream above the screen rack. The tailrace gage is similar in construction to the crest gage and is attached to the timber crib which forms the dyke. It is on the left side of the tailrace, about 15 feet below the power house. The bench mark to which both gages are referred is the downstream corner on the left side of the right abutment near the waste gates. Its elevation is 8.07 feet above the zero of the crest gage and 23.86 feet above the zero of the tailrace gage. The gages are read and the record furnished by A. E. Hare, the engineer at the Lozier Company's plant.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Saranac River near Plattsburg, N. Y., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,092	846	392	669	1,320	545	426	706	575
2	.....	1,778	736	274	1,593	1,002	564	501	708	590
3	.....	1,778	658	392	1,419	846	669	638	473	583
4	.....	3,924	669	333	1,002	712	470	615	531	615
5	.....	2,920	712	168	849	626	496	670	601	648
6	.....	2,231	626	363	755	581	405	613	637	515
7	.....	2,166	613	529	669	333	430	574	746	730
8	.....	2,517	526	274	626	600	581	572	658	659
9	.....	2,662	276	245	626	572	304	584	734	579
10	.....	2,373	136	333	364	846	449	1,214	772	584
11	.....	2,093	254	392	206	846	392	1,334	768	617
12	.....	1,759	689	624	486	2,332	476	1,035	692	543
13	.....	1,698	545	1,384	474	1,573	443	750	771	517
14	.....	1,095	545	1,218	474	1,197	505	701	611	640
15	.....	1,093	583	306	474	994	.....	627	443	522
16	.....	1,593	486	755	592	706	411	427	911	574
17	.....	1,093	405	247	705	755	411	472	728	486
18	.....	1,462	583	545	599	693	362	801	695	417
19	.....	1,450	583	545	330	755	512	1,103	730	488
20	.....	1,073	507	725	669	1,037	529	1,037	647	449
21	.....	1,415	268	1,392	1,090	941	667	775	622	813
22	.....	1,711	507	1,714	894	919	505	688	592	664
23	.....	1,734	515	989	1,037	706	505	611	736	679
24	.....	1,523	486	306	1,247	712	333	588	709	689
25	.....	1,447	545	1,194	919	432	274	615	605	722
26	.....	1,054	608	1,037	615	626	361	696	528	838
27	2,229	941	644	864	755	626	195	502	575	555
28	2,736	306	238	658	755	626	212	562	550	722
29	2,300	306	356	712	669	599	545	565	443	609
30	1,839	894	425	669	941	572	451	517	601	610
31	1,592	.....	486	.....	1,300	693	.....	557	.....	571

Estimated monthly discharge of Saranac River near Plattsburg, N. Y., for 1903.

[Drainage area, 624 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April	3,924	306	1,639	2.62	2.92
May	846	136	518	.83	.95
June	1,714	168	652	1.04	1.16
July	1,593	206	768	1.23	1.42
August	2,332	333	831	1.33	1.53
September	669	195	448	.72	.80
October	1,334	426	689	1.10	1.27
November	772	443	651	1.04	1.16
December	838	417	607	.97	1.12

SARANAC RIVER NEAR SARANAC LAKE, N. Y.

The headwaters of Saranac River lie in southern Franklin County. The southern boundary of the drainage basin is the Ampersand Mountain range. The stream drains the north slope of the most elevated region of the State. To the northwest of Ampersand Range is a region of lakes and ponds, in which region arise three of the principal streams of the St. Lawrence-Champlain drainage in New York—St. Regis, Raquette, and Saranac rivers. In 1854 a timber dam was built below Lower Saranac Lake for the purpose of flooding logs. In 1898 a masonry dam and lock were erected by the State at this point. The drainage basin above the State dam is in part very precipitous, and is almost entirely forest covered.

Saranac River enters Lake Champlain at Plattsburg, and owing to its somewhat equalized flow and rapid fall presents numerous opportunities for power development.

During the months of July and August, 1902, a series of gage readings were taken at the State dam under direction of the late Elnathan Sweet. In March, 1903, a gage was erected in the pond above this dam and observations of the depth of overflow, opening of wasteway, and lockage were taken during the navigation season, May 17 to October 31, 1903, inclusive, by Ben. R. Baker. The dam, which is of masonry, 8 feet high, has a nearly vertical downstream face and an upstream inclination on the coping of the crest of 1 foot in 6, backed by slope paving with a batter of 3 horizontal to 1 vertical. Coefficients of discharge have been computed from the experiments at Cornell University hydraulic laboratory. The surface areas of the several lakes and ponds are as follows:

Water surface in Saranac Basin, N. Y.

	Sq. miles.
Upper Saranac Lake	8.5
Middle Saranac Lake	2.5
Lower Saranac Lake	3.5
Big Clear pond	2.0
Fallenshy's pond	2.0
Combined area, thirty other lakes and ponds	7.0
Total water-surface area	25.5

About 16 per cent of the upper drainage area is water surface.

Drainage areas of Saranac River, N. Y.

	Sq. miles.
Above Saranac Lake State dam	157
Above Saranac Lake village	202
Above Franklin Falls	307
North Branch Saranac River	137
At junction North Branch	499
Above High Falls	518
Above Cadyville	593
Above Kent Falls	596
Above Morrisonville	598
Above Lozier dam	624
Above mouth	630

Estimated monthly discharge of Saranac River near Saranac Lake, N. Y., for 1903.

[Drainage area, 158 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 17–31		104	120	0.760	
June	208	52	130	.823	0.91
July	228	136	173	1.095	1.27
August	228	180	212	1.342	1.54
September	189	83	136	.861	.95

Mean daily discharge, in second-feet, of Saranac River at State dam near Saranac Lake, N. Y., for 1902.

Day.	July.	Aug.	Day.	July.	Aug.	Day.	July.	Aug.
1		141	12		225	23		174
2		163	13		212	24		
3			14		193	25	138	174
4		212	15		201	26	148	174
5		193	16		193	27		174
6		193	17			28	156	156
7		212	18		186	29	138	
8		204	19		186	30	131	
9		212	20		178	31	128	
10			21		174			
11		181	22		174			

Mean daily discharge, in second-feet, of Saranac River at State dam near Saranac Lake, N. Y., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	104	208	228	170	17	162	128	170	208	136
2	.....	104	189	228	170	18	136	153	153	208	128
3	.....	104	189	228	170	19	128	153	136	208	120
4	.....	90	170	208	170	20	136	153	136	218	104
5	.....	76	170	208	189	21	136	170	153	228	104
6	.....	76	170	208	189	22	.....	189	170	228	104
7	.....	76	170	208	189	23	136	189	170	228	104
8	.....	76	170	208	170	24	120	189	170	208	104
9	.....	64	170	208	170	25	104	189	170	208	104
10	.....	64	170	208	162	26	104	208	170	208	104
11	.....	64	170	228	145	27	104	208	170	208	104
12	.....	52	170	238	136	28	104	208	170	208	90
13	.....	.....	170	218	136	29	104	208	180	198	90
14	.....	76	170	208	136	30	104	208	228	189	83
15	.....	90	170	208	136	31	104	.....	228	180	.....
16	.....	104	170	208	136						

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

Observations at the dam of the Hannawa Falls Power Company on Raquette River were taken from September 31, 1902, to March 31, 1903. The discharge has not been computed. A gaging station was established at Massena Springs highway bridge on Raquette River September 21, 1903. Observations were continued until October 17, 1903, and will be again taken up when a suitable observer can be found. The gage is a vertical scale attached to the right abutment on the upstream side of the bridge. The bench mark is a cross painted on the outside downstream corner of the foundation adjacent to the sulphur springs. Its elevation is 12.21 feet above gage datum. The bridge has a single span of 167.5 feet. The current is swift and uniform. The banks are not subject to overflow. The channel is straight for 300 feet above and 1,000 feet below the bridge. The headwaters of Raquette River are on an elevated plateau dotted with mountains interspersed with lakes. The region is timbered, but numerous marsh and swamp areas exist. Many of these are on the divide and feed streams flowing in opposite directions. Raquette River drains a long, narrow basin extending from Hamilton County to St. Lawrence River. Above Piercefield the drainage basin broadens out, including a region containing many lakes and ponds and affording ample opportunities for storage development, as shown by the following list of lakes.

Lakes in basin of Raquette River, N. Y.

	Elevation of water surface.	Surface area.	Drainage area.
	Feet.	*Sq. miles.*	*Sq. miles.*
Blue Mountain Lake, including Eagle and Utowana lakes	1,788	3.9	39.3
Raquette Lake	1,762	8.3	93.9
Forked Lake	1,741	2.5	39.8
Long Lake	1,629	4.7	152.2
Big Tupper Lake	1,554	8.0	59.3

Drainage areas of Raquette River.

	Sq. miles.
Blue Mountain and Utowana lakes	18
South inlet, above mouth	33
Above Raquette Lake outlet	118
Above Forked Lake dam	173
Above Long Lake outlet	274
Above Raquette pond dam	695
Above Hannawa Falls	953
Above Massena Springs	1,169
Above mouth	1,219

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

This stream has its source in a region of lakes and timbered swamps in southern St. Lawrence County. The largest of the lakes is Cranberry Lake, which affords valuable storage to water-power users on its outlet, East Branch Oswegatchie River. The east and west branches flow in a general northwesterly direction and join near Talcville. From Gouverneur to Oxbow the river flows southwest and then turns abruptly to the northeast. At Galilee it is joined by the outlet of Black Lake, and finally enters St. Lawrence River at Ogdensburg. A gaging station was established at Eel weir bridge May 16, 1903. Observations of the stream stage are made twice each day by Joseph H. LaRue. The Eel weir bridge is located just below the junction of Oswegatchie River and Black Lake outlet. The channel is in rock, and is partly artificial, rock underneath the bridge having been removed by blasting to increase the bridge opening. A chain gage is attached to the iron work of the bridge on the upstream side of the right span. The bench mark is a square chisel draft on the upstream side of the right abutment. Its elevation is 16.72 feet above gage datum. The bridge consists of two spans of 130 feet each.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Drainage areas of Oswegatchie River.[a]

	Sq. miles.
East Branch Oswegatchie River above mouth	358
West Branch Oswegatchie River above mouth	272
Oswegatchie River below junction of two branches	630
Oswegatchie River above Gouverneur	727
Oswegatchie River above Galilee	1,033
Indian River above Philadelphia	216
Black Lake watershed above Galilee	544
Oswegatchie River below Black Lake junction	1,577
Oswegatchie River above Ogdensburg	1,609
Black Lake water surface	17
Cranberry Lake water surface	13

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., in 1900 and 1903.

Date.	Hydrographer.	Gage height.	Discharge.
1900.		*Feet.*	*Second-feet.*
September 25	R. E. Horton		614
1903.			
May 5	C. C. Covert	4.70	1,044
May 14	H. H. Halsey	4.60	830
Do	do	4.60	729
September 22	C. C. Covert	4.70	812

[a] From Bien's Atlas of N. Y. State.

Rating table for Winooski River at Winooski, Vt., from March 18 to November 28, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
38.0	305	39.1	1,715	40.2	3,415	41.3	5,535
38.1	420	39.2	1,855	40.3	3,585	41.4	5,750
38.2	537	39.3	2,000	40.4	3,760	41.5	5,965
38.3	657	39.4	2,145	40.5	3,935	41.6	6,180
38.4	780	39.5	2,295	40.6	4,115	41.7	6,395
38.5	906	39.6	2,445	40.7	4,300	41.8	6,610
38.6	1,034	39.7	2,600	40.8	4,495	41.9	6,825
38.7	1,165	39.8	2,755	40.9	4,695	42.0	7,040
38.8	1,300	39.9	2,915	41.0	4,900		
38.9	1,435	40.0	3,080	41.1	5,110		
39.0	1,575	40.1	3,245	41.2	5,320		

Tangent at 41.2 feet gage height. Differences above this point 215 per tenth. Discharge under gage height 38.0 feet not applied on account of low velocity, rendering the discharge measurements uncertain, and on account of fluctuations of gage height at dam below.

Estimated monthly discharge of Winooski River at Winooski, Vt., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 18–31	23,595	4,025	11,873
April	7,792	1,034	2,871
May 1–21	1,165	305	616
June 12–30	3,245	537	1,416
July 1–15, 20–31 [a]	2,000	305	810
August 1, 2	657	420	538
September			
October 7–31	3,245	970	1,866
November 1–28	4,495	1,300	2,327

[a] 1 to 15 inclusive and 20 to 31 inclusive.

OTTER CREEK AT MIDDLEBURY, VT.

This station was established April 1, 1903, by H. K. Barrows. It is located at the railroad bridge in the village of Middlebury, above and within the influence of the dam used for power purposes. The water, however, never falls below the crest of the dam. The drainage area at this point is 615 square miles. A chain gage is attached to the downstream truss of this bridge; length of chain is 17.52 feet to the 10-foot tag. It is referred to a bench mark on top of south bolt in bridge seat on downstream side of north abutment; elevation, 20.08 feet above gage datum. Measurements are made from a boat at medium stages, and from a stone-arch highway bridge about one-half mile downstream at low stages of the river. The current at the gage is small, except at high stages of the river; at the stone-arch bridge it is medium at low stages of the river. The banks are high and not subject to overflow, and the bed is permanent. The gage is read twice daily by R. P. Bingham, of Middlebury.

The observations at this station during 1903 have been made under the direction of N. C. Grover, district hydrographer.

Discharge measurements of Otter Creek at Middlebury, Vt., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 3	C. B. Brownell	15.90	3,730
April 18	H. K. Barrows	13.62	1,335
April 28	do	12.75	640
May 9	do	12.35	455
May 19	do	12.20	235
June 24	do	13.05	835
July 7	do	12.20	245
July 18	N. C. Grover	12.00	284
August 6	H. K. Barrows	12.25	337
September 14	do	11.71	190
November 21	do	12.48	484

main crest is 380.6 feet in length, is level, and at an elevation of 587.96 feet above tide. There are two additional sections on the right side. One, at an elevation of 590.96 feet, is 14.1 feet long; and the other, at an elevation of 593.46 feet, is 17.9 feet long.

A similarly constructed dam 117 feet long at the left bank serves as an auxiliary spillway and as a headrace wall. It has an average crest elevation of 591 feet.

The gage is attached vertically to a crib at the juncture of the main and auxiliary spillways, 8 feet upstream from the crest, and a correction is made to the gage readings for velocity of approach during high water. The discharge over the spillways has been computed by means of the weir formula, using coefficients derived from Cornell experiment No. 5 for a dam of similar cross section. The dam was constructed in 1900, rests on limestone foundation, and is very nearly water-tight. The headrace is closed by a bulkhead, no water wheels having been installed.

The gage readings are taken twice daily, at 7 a. m. and again at 6 p. m., by A. H. Tucker. A record of high water was kept at this dam May and June, 1901, but the results are not available for publication at present.

This station was maintained during 1903, but the computation of the discharge has been withheld awaiting a better determination of the profile of the crest of the dam.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

BEAVER RIVER NEAR CROGHAN, N. Y.

Beaver River rises in western Hamilton County, crosses Herkimer County and emerges from the Adirondacks at No. 4 on the Lewis County line. The flow from the tributary drainage basin above Beaver, comprising an area of 153 square miles, or 48 per cent of the entire drainage area, is regulated by storage in the Beaver flow or "Stillwater," an artifical lake formed by a timber dam 16 feet high.

A new masonry dam has been constructed by the State of New York to replace the timber dam. Below this storage reservoir the drainage basin is largely a timber-covered sandy plain, underlain by granitic rock, over which the stream falls, making numerous precipitous descents. Water power is developed at various points. A temporary gaging station was established May 10, 1901, at Tisse's bridge, which crosses the stream between the villages of Belfort and Croghan at the head of Tisse's Falls, a point where the gagings will be least obstructed by either logs or ice. The bridge consists of two spans of 70 and 51 feet width, crossing two arms of the stream on opposite sides of a wooded, rocky island.

A 12-foot cypress gage, graduated to feet and tenths, was secured to the downstream face of the right abutment of the right span.

One observation of the river stage has been taken each day by the observer, Nicholas Tisse.

Owing to the existence of cross currents under the bridge, current-meter observations of the velocity are taken in every square foot of the cross section of the stream, and the direction of flow of the corresponding filaments, as well as their velocity, is taken into consideration in computing the discharge.

Five current-meter measurements have been made, covering the range of variation in the stream stage. They are considered sufficient to furnish an approximate estimate of the daily discharge from the gage readings.

The State masonry dam at Beaver having been completed, observations of the gate openings, head, and depth on the spillway at that point were begun in 1903. From these the outflow from the storage reservoir will be computed. The observations at Tisse's bridge were discontinued September 26, 1903. In the absence of topographic maps, the drainage area above Tisse's bridge has been estimated at 242 square miles. The drainage area above the storage reservoir at Beaver is mountainous and timber covered. It contains a large proportion of lake surface, including Red Horse Chain.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Beaver River near Croghan, N. Y., in 1901–1903.

Date.	Hydrographer.	Gage height.	Discharge.
1901.		*Feet.*	*Second-feet.*
May 30	R. E. Horton	2.98	560
June 10	J. D. Luther	3.52	996
July 4	do	2.02	293
1902.			
August 26	C. C. Covert	2.37	554
1903.			
March 18	C. C. Covert	5.32	3,499

Mean daily gage height, in feet, of Beaver River near Croghan, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.7	3.4	3.4	5.0	3.0	2.0	2.6	4.9	2.4
2	2.7	3.1	3.5	5.0	4.2	2.0	2.7	4.8	2.3
3	2.5	3.2	3.8	5.0	2.9	2.0	3.0	4.8	2.0
4	2.8	3.4	4.0	4.8	4.2	1.9	2.8	4.7	2.0
5	2.7	3.3	4.1	4.8	2.1	2.0	2.6	4.6	2.0
6	2.7	3.4	3.4	5.0	1.8	2.0	1.9	4.7	2.4
7	2.7	3.2	3.4	5.0	4.5	1.9	2.0	4.7	2.4
8	2.6	3.1	3.8	5.0	2.2	2.0	2.7	4.6	2.3
9	2.4	3.0	4.0	5.2	3.9	2.1	2.8	4.7	2.0
10	2.4	3.0	4.3	2.5	4.5	2.0	2.8	4.6	2.0
11	2.4	2.8	5.0	3.5	4.1	2.5	2.9	3.4	2.0
12	2.4	3.1	4.9	.....	4.2	2.6	2.6	3.2	2.0
13	2.3	3.2	5.0	.....	4.0	2.8	2.4	3.2	2.1
14	2.4	3.2	5.1	.....	2.0	2.8	2.4	3.1	2.2
15	2.4	3.3	5.0	.....	2.0	2.8	1.6	3.2	2.2
16	2.4	3.2	5.0	.....	2.3	2.6	1.4	3.4	2.2
17	2.4	3.0	5.0	.....	1.9	2.2	1.4	3.4	2.1
18	2.1	3.0	5.4	.....	3.4	2.2	1.6	3.3	2.1
19	2.4	2.9	5.8	2.9	2.3	2.0	1.8	3.3	2.1
20	2.3	2.8	5.8	3.4	.....	2.0	2.0	2.6	2.1
21	2.5	2.8	5.9	2.9	2.3	2.3	2.8	2.4	2.1
22	2.7	2.7	6.4	3.0	1.3	2.5	2.6	2.4	2.1
23	2.6	2.6	6.6	3.0	1.5	2.6	2.4	2.2	2.0
24	2.5	2.5	6.4	2.9	1.3	2.8	2.4	2.2	2.0
25	2.9	2.5	6.0	3.0	1.4	2.8	2.6	2.3	2.0
26	3.0	2.7	5.9	2.0	1.4	2.7	2.8	2.3	[a] 2.1
27	2.7	2.8	5.8	3.0	1.6	2.6	3.0	2.4	.....
28	2.8	3.0	5.4	3.2	1.6	2.6	3.7	2.4	.....
29	2.9	.....	5.4	2.5	1.5	2.8	4.0	2.5	.....
30	3.1	.....	4.5	4.2	1.5	2.8	4.7	2.4	.....
31	3.4	.....	4.9	.....	1.6	.....	5.0	2.4	.....

[a] End of record.

Rating table for Beaver River near Croghan, N. Y., for 1901–1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.80	207	2.80	610	3.80	1,200	4.80	2,370
1.90	241	2.90	660	3.90	1,280	4.90	2,530
2.00	275	3.00	700	4.00	1,350	5.00	2,700
2.10	314	3.10	760	4.10	1,450	5.10	2,960
2.20	353	3.20	810	4.20	1,560	5.20	3,210
2.30	392	3.30	870	4.30	1,660	5.30	3,480
2.40	431	3.40	920	4.40	1,770	5.40	3,770
2.50	470	3.50	980	4.50	1,870	5.50	4,050
2.60	520	3.60	1,050	4.60	2,040		
2.70	560	3.70	1,130	4.70	2,200		

Mean daily discharge, in second-feet, of Beaver River near Croghan, N. Y., for 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	.....	.....	.....	.....	760	314	314	1,050	470	520	520
2	.....	.....	.....	.....	.....	760	314	275	.....	560	560	520
3	.....	.....	.....	.....	.....	870	275	207	.....	700	470	560
4	.....	.....	.....	.....	.....	980	275	.....	.....	760	470	520
5	.....	.....	.....	.....	.....	1,050	314	275	560	610	470	560
6	.....	.....	.....	.....	.....	980	314	275	353	660	431	610
7	.....	.....	.....	.....	.....	1,050	314	314	353	610	470	560
8	.....	.....	.....	.....	.....	980	314	314	275	560	431	470
9	.....	.....	.....	.....	.....	1,130	275	353	253	610	431	660
10	.....	.....	.....	.....	.....	1,050	314	392	241	610	353	610
11	.....	.....	.....	.....	.....	980	275	392	275	560	810	660
12	.....	.....	.....	.....	.....	760	275	560	241	560	700	920
13	.....	.....	.....	.....	.....	660	275	353	314	470	431	980
14	.....	.....	.....	.....	.....	660	241	314	275	610	810	870
15	.....	.....	.....	.....	.....	560	241	560	520	660	870	.....
16	.....	.....	.....	.....	.....	431	241	392	520	700	760	3,770
17	.....	.....	.....	.....	660	353	207	353	610	700	610	1,660
18	.....	.....	.....	.....	431	353	241	.....	560	700	660	1,350
19	.....	.....	.....	.....	431	392	241	.....	520	700	560	1,350
20	.....	.....	.....	.....	314	560	207	.....	470	700	610	1,560
21	.....	.....	.....	.....	353	660	.....	.....	392	660	520	1,280
22	.....	.....	.....	.....	470	660	.....	.....	353	660	520	1,200
23	.....	.....	.....	.....	275	392	.....	275	392	610	431	1,130
24	.....	.....	.....	.....	431	660	392	470	431	392	470	920
25	.....	.....	.....	.....	275	520	392	392	353	700	560	870
26	.....	.....	.....	.....	560	520	.....	353	392	392	610	920
27	.....	.....	.....	.....	314	431	353	.....	392	610	560	1,050
28	.....	.....	.....	.....	660	470	275	.....	.....	610	610	920
29	.....	.....	.....	.....	660	660	660	207	.....	610	610	660
30	.....	.....	.....	.....	700	392	560	241	275	700	560	660
31	.....	.....	.....	.....	610	.....	560	275	.....	520	.....	660
Mean	.....	.....	.....	.....	476	689	293	278	365	612	563	1,142

Mean daily discharge, in second-feet, of Beaver River near Croghan, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	700	470	1,350	1,870	275	920	700	470	353	314	560	431
2	660	431	1,870	1,770	1,350	810	560	470	275	353	470	392
3	610	431	1,770	1,870	1,870	700	431	920	520	353	392	520
4	610	431	1,280	1,130	1,350	810	431	700	431	353	275	560
5	660	431	1,130	980	1,870	810	470	431	275	275	275	560
6	610	431	980	275	1,560	700	470	431	275	275	241	560
7	560	431	920	.....	1,770	920	431	353	275	314	241	520
8	560	431	470	980	2,700	1,050	470	392	275	353	275	520
9	520	392	470	1,560	1,770	920	431	431	314	353	353	660
10	520	431	470	1,450	1,350	1,280	470	700	275	314	431	660
11	470	392	560	1,560	1,050	1,050	470	560	353	314	700	700
12	470	392	870	1,770	660	810	470	431	392	353	810	810
13	470	353	1,770	1,660	1,560	470	431	275	353	275	810	920
14	470	392	2,530	920	431	353	470	275	353	275	660	980
15	470	431	2,370	700	353	431	520	275	275	.....	560	980
16	470	431	2,530	700	1,770	810	700	314	207	.....	560	920
17	431	431	2,700	810	2,700	1,130	810	810	207	353	431	920
18	431	520	3,770	660	2,040	610	810	920	275	353	520	870
19	810	560	3,210	1,560	1,560	870	700	760	241	392	560	810
20	760	610	2,370	920	520	1,200	700	560	241	353	560	700
21	760	610	1,560	392	1,560	1,050	700	431	207	353	470	700
22	660	660	1,560	520	1,770	980	660	700	207	431	353	660
23	560	660	1,770	920	1,560	1,200	610	810	241	431	431	660
24	520	560	1,770	1,560	1,560	520	610	700	207	353	431	760
25	470	560	1,350	980	3,210	610	660	700	275	810	431	700
26	470	610	1,280	810	3,770	431	610	470	207	810	431	610
27	470	1,280	1,350	980	.....	275	470	353	207	700	392	660
28	700	1,350	1,130	700	1,560	431	470	353	275	700	392	560
29	760	.....	1,350	2,040	920	470	431	353	275	660	392	560
30	560	.....	1,870	1,130	980	392	520	314	314	610	431	470
31	353	.....	1,770	.....	920	.....	431	314	.....	560	.....	520
Mean	566	540	1,618	1,109	1,620	767	552	515	286	401	461	673

Mean daily discharge, in second-feet, of Beaver River near Croghan, N. Y., for 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	560	920	920	2,700	700	275	520	2,530	431	.....	.....	.....
2	560	760	980	2,700	1,560	275	560	2,370	392	.....	.....	.....
3	470	810	1,200	2,700	660	275	700	2,370	275	.....	.....	.....
4	610	920	1,350	2,370	1,560	241	610	2,200	275	.....	.....	.....
5	560	870	1,450	2,370	314	275	520	2,040	275	.....	.....	.....
6	560	920	920	2,700	207	275	241	2,200	431	.....	.....	.....
7	560	810	920	2,700	1,870	241	275	2,200	431	.....	.....	.....
8	520	760	1,200	2,700	353	275	560	2,040	392	.....	.....	.....
9	431	700	1,350	3,210	1,280	314	610	2,200	275	.....	.....	.....
10	431	700	1,660	470	1,870	275	610	2,040	275	.....	.....	.....
11	431	610	2,700	980	1,450	470	660	920	275	.....	.....	.....
12	431	760	2,530	(a)	1,560	520	520	810	275	.....	.....	.....
13	392	810	2,700	(a)	1,350	610	431	810	314	.....	.....	.....
14	431	810	2,960	(a)	275	610	431	760	353	.....	.....	.....
15	431	870	2,700	(a)	275	610	(b)	810	353	.....	.....	.....
16	431	810	2,700	(a)	392	520	.....	920	353	.....	.....	.....
17	431	700	2,700	(a)	241	353	.....	920	314	.....	.....	.....
18	314	700	3,770	(a)	920	353	.....	870	314	.....	.....	.....
19	431	660	(b)	660	392	275	207	870	314	.....	.....	.....
20	392	610	.....	920	(b)	275	275	520	314	.....	.....	.....
21	470	610	.....	660	392	392	610	431	314	.....	.....	.....
22	560	560	.....	700	(b)	470	520	431	314	.....	.....	.....
23	520	520	.....	700	.....	520	431	353	275	.....	.....	.....
24	470	470	.....	660	.....	610	431	353	275	.....	.....	.....
25	660	470	.....	700	.....	610	520	392	275	.....	.....	.....
26	700	560	.....	275	.....	560	610	392	314	.....	.....	.....
27	560	610	.....	700	.....	520	700	431	.....	.....	.....	.....
28	610	700	3,770	810	.....	520	1,130	431	.....	.....	.....	.....
29	660	.....	3,770	470	.....	610	1,350	470	.....	.....	.....	.....
30	760	.....	1,870	1,560	.....	610	2,200	431	.....	.....	.....	.....
31	920	.....	2,530	.....	.....	.....	2,700	431	.....	.....	.....	.....
Mean	525	715	3,003	1,496	608	425	626	1,127	323	.....	.....	.....

a No record. b Above upper limit of rating table.

Estimated monthly discharge of Beaver River near Croghan, N. Y., for 1901–1903.

[Drainage area, 274.4 square miles.]

	Discharge in second-feet.			Run-off.		Rainfall in inches.[a]
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1901.						
May 17–31	700	275	476	1.73	1.99	3.40
June	1,130	353	689	2.51	2.80	5.38
July[b]	660	50	293	1.07	1.23	4.67
August[b]	560	50	278	1.01	1.16	5.82
September[b]	1,050	30	365	1.33	1.48	5.85
October	760	392	612	2.23	2.57	3.99
November	870	353	563	2.05	2.29	7.52
December[b]	6,430	470	1,142	4.16	4.80	5.17
1902.						
January	810	353	566	2.06	2.37	3.33
February	1,350	353	540	1.97	2.05	5.81
March	3,770	470	1,618	5.89	6.79	6.35
April[b]	2,040	95	1,109	4.04	4.51	5.27
May[b]	3,900	275	1,620	5.90	6.80	4.03
June	1,280	275	767	2.79	3.11	5.04
July	810	431	552	2.01	2.32	7.36
August	920	275	515	1.87	2.16	5.48
September	520	207	286	1.04	1.16	2.72
October[b]	810	50	401	1.46	1.68	5.26
November	810	241	461	1.68	1.87	4.36
December	980	392	673	2.45	2.82	5.40
The year	3,900	50	759	2.76	37.64	60.41
1903.						
January	920	314	525	1.91	2.20	6.16
February	920	470	715	2.60	2.70	[c]5.67
March[b]	6,800	920	3,003	10.93	12.60	[c]4.06
April 1–11; 19–30	3,210	275	1,496	5.45	6.08	2.46
May[b]	1,870	75	608	2.21	2.55	.45
June	610	241	425	1.55	1.73	7.21
July[b]	2,700	95	626	2.28	2.63	10.03
August	2,530	353	1,127	4.10	4.73	4.18
September 1–26	431	275	323	1.18	1.32	1.77

[a] At No. 4.
[b] Estimated discharge on days above or below limit of rating curve included in monthly mean.
[c] Mean of Lowville and North Lake.

MOOSE RIVER AT MOOSE RIVER, N. Y.

Moose River drainage basin lies mainly in Herkimer and Hamilton counties, N. Y. The stream is tributary to Black River at Lyons Falls. The drainage basin is underlain by granitic gneiss, the soil being, in general, sandy and timber covered. The headwaters are in the region of maximum precipitation of the State as well as in the region of greatest accumulated snowfall. The flow for the spring months is controlled by lumbermen's dams, large volumes of water being turned into the stream when required for log driving.

The gaging station was established June 5, 1902. The gage is vertical and is in two sections attached to posts on the left bank. It is read twice each day by Chris. Hannan. Discharge measurements are made from a cable having a span of 269 feet. The channel is divided by an island a short distance above the gage, at which point ice gorges are formed during the spring freshets. A short distance below the station a fall occurs. The bed of the stream is composed of cobblestones. The current is smooth and the gaging section is regular. The gage was carried away by a flood February 28, 1903, and was replaced at a slightly different elevation.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Drainage areas of Moose River.

	Sq. miles.
South Branch Moose River, above Indian River	67
Indian River, above mouth	50
Middle Branch Moose River, above Old Forge	52
Moose River, above Moose River gaging station	374
Moose River, above mouth	440

Discharge measurements of Moose River at Moose River, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 11	C. C. Covert	1.10	287
June 13	L. A. Mitchell	4.20	1,821
Do	do	3.90	1,580
June 14	do	2.87	940
Do	do	2.69	884
July 4	H. H. Halsey	1.80	438
Do	do	1.80	485

Mean daily gage height, in feet, of Moose River at Moose River, N. Y.,[a] for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.90	3.35	4.45	4.90	1.90	1.00	1.80	2.50	1.95	1.50	1.75	1.25
2	1.75	3.45	5.00	4.55	1.80	1.00	2.00	1.85	1.70	1.65	1.60	1.20
3	1.75	3.30	4.45	4.60	1.65	.90	2.30	1.60	1.35	1.65	1.50	1.15
4	2.05	3.20	4.10	6.70	1.60	.90	1.90	1.50	.95	1.55	1.65	1.10
5	2.15	3.20	3.70	5.60	1.50	1.10	1.45	2.30	1.00	1.85	1.55	1.05
6	2.05	2.70	3.35	4.60	1.45	1.10	2.10	3.10	.90	2.50	1.55	1.05
7	1.90	2.80	3.10	4.15	1.40	1.10	2.80	2.40	.55	2.10	1.50	1.10
8	1.80	2.70	2.95	4.40	1.35	1.15	2.40	2.10	.70	1.70	1.55	1.10
9	1.70	2.60	3.35	4.40	1.45	1.05	1.95	2.20	.70	4.05	1.35	1.05
10	1.65	2.60	4.25	4.60	1.30	1.00	1.70	2.55	.90	7.50	1.30	1.00
11	1.60	2.50	4.85	4.60	1.20	1.20	1.55	2.50	1.40	5.15	1.30	1.05
12	1.70	2.95	5.50	4.25	1.15	2.40	1.35	3.80	1.55	3.95	1.25	1.10
13	1.80	3.55	([b])	4.15	1.10	3.90	1.05	4.25	1.55	3.50	1.20	1.15
14	1.80	3.55	([b])	4.15	1.20	2.20	1.05	2.80	1.45	3.35	1.25	1.15
15	1.80	3.35	([b])	4.10	1.20	1.85	.95	2.45	1.40	3.20	1.05	1.15
16	1.80	3.15	4.80	3.95	1.10	1.45	.90	2.05	1.40	3.10	.95	1.40
17	1.80	2.95	4.85	3.75	1.10	1.25	.85	1.85	1.55	3.40	1.20	1.50
18	1.70	2.80	5.35	3.55	1.10	1.15	.80	1.60	1.70	5.90	2.25	1.30
19	1.70	2.70	6.15	3.20	1.10	1.10	1.10	1.30	1.80	5.35	2.25	1.50
20	1.70	2.60	7.20	2.95	1.10	1.05	1.45	1.20	1.65	4.20	1.85	1.65
21	1.80	2.50	([b])	2.75	1.20	1.45	1.65	1.15	1.55	3.75	1.65	1.90
22	1.80	2.50	.....	2.45	1.20	3.00	1.65	1.05	1.50	3.40	1.75	2.50
23	1.80	2.50	.....	2.55	1.20	2.85	3.00	1.05	1.60	3.25	1.55	2.55
24	1.80	2.40	.....	2.95	1.20	2.15	3.25	.95	1.45	3.05	1.50	2.60
25	1.80	2.30	.....	2.65	1.20	2.60	2.40	1.15	1.45	3.35	1.45	2.45
26	1.80	2.30	.....	2.35	1.20	2.75	1.60	2.15	1.40	2.85	1.45	2.25
27	1.80	2.30	.....	2.25	1.05	2.80	1.95	1.95	1.40	2.50	1.40	2.20
28	1.80	2.70	.....	2.10	1.00	2.05	1.70	1.50	1.55	2.30	1.35	2.10
29	1.80	.....	5.95	1.95	1.10	1.75	1.45	1.25	1.60	2.10	1.40	2.20
30	2.20	.....	5.70	1.90	1.10	1.50	2.20	1.30	1.65	1.95	1.35	2.00
31	2.95	.....	5.35	.....	1.00	.....	2.85	1.40	.....	1.90	.....	1.85

[a] Stream frozen in winter.

[b] Ice freshet—stream obstructed.

SALMON RIVER NEAR PULASKI, N. Y.

This station was established September 5, 1900. It is located at Fox bridge, 2 miles above Pulaski, N. Y. The original gage was a vertical board scale attached to the upstream end of the center pier, having its zero at an elevation of 88.41 feet, the top of the capstone of the central pier, upstream end, being used as a bench mark, with an arbitrary elevation of 100. This gage was carried away by ice in the winter of 1901–2, and was replaced July 23, 1902, by a standard chain gage, having its datum at an elevation of 87.21 feet, or 1.2 feet below that of the original gage. In the following table are given the results of all current-meter measurements that have been made, with the stage referred to the bench mark above described. The gage readings have been taken twice each day by S. J. Fox, and have been continued throughout winter and summer. The winter readings were obtained by observing the height to which the water rose in a hole in the ice underneath the gage. Owing to the obstruction of the river channel by ice, the discharge for the winter period has not been computed. Discharge measurements made during 1903 indicate that the excessive anchor-ice formation of the preceding winter, followed by severe spring freshets, modified the channel near the bridge. The rating table deduced from measurements during 1903 indicates a lower discharge for the smaller gage heights than the previous rating table. The drainage basin above the gaging station is rolling and very sandy, rock lying near the surface in the upper regions of the basin, in which there are also extensive areas of original forest. The drainage basin is located in a region of heavy snowfall, several feet of snow sometimes accumulating in the forest areas, and by gradually melting feeding the stream during March and April. The current-meter measurements are made at 5-foot intervals across the stream from the downstream side of Fox bridge, which is located about 2 miles upstream from Pulaski. The bridge consists of two spans, 183 feet between abutments. The stream bed is of gravel and cobble, relatively flat and shallow. There are also two small overflow channels and a flood plain at an average elevation at the highway of 7.5 feet gage height. The discharge through these is included in the high-water measurements.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Salmon River near Pulaski, N. Y., in 1900–1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
1900.			
September 4		2.23	102
1901.			
April 12	R. E. Horton	4.60	2,536
April 24	do	5.50	3,476
May 13	do	3.34	824
May 21	J. D. Luther	2.89	422
June 1	do	3.70	1,070
June 8	do	5.30	3,437
1902.			
July 2	R. E. Horton	3.94	1,392
July 5	H. R. Beebe	4.95	2,889
July 6	do	5.03	2,916
Do	do	5.06	2,881
July 23	do	3.49	842
1903.			
February 27	C. C. Covert	3.60	[b]488
Do	do	3.60	[b]492
March 19	do	6.25	5,866
Do	do	6.20	5,869
May 5	do	3.10	416
May 12	do	2.80	260
May 15	H. H. Halsey	2.75	305
June 24	do	3.25	516
Do	do	3.25	520
September 26	do	2.45	124

[a] Referred to datum of chain gage.
[b] Measurements made in left-hand section, containing considerable anchor ice. Right-hand section frozen solid.

Mean daily gage height, in feet, of Salmon River near Pulaski, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.28	5.12	5.18	4.58	2.98	2.45	3.40	3.40	3.08	2.75	3.00	3.00
2	3.32	5.10	5.28	4.50	3.00	2.42	4.05	3.10	2.88	3.15	3.00	3.00
3	3.48	4.70	4.95	4.90	2.90	2.42	3.40	2.88	2.78	3.15	2.90	3.00
4	4.18	4.45	4.45	6.38	3.08	2.40	3.08	2.82	2.70	2.95	2.90	2.90
5	3.92	4.52	4.12	5.05	3.12	2.40	2.92	3.40	2.60	3.45	2.95	2.90
6	3.62	4.45	4.08	4.40	3.02	2.40	2.88	3.40	2.60	3.60	3.50	2.90
7	3.35	4.48	4.58	4.42	2.92	2.40	2.98	3.42	2.55	3.25	3.30	3.00
8	3.38	4.20	4.95	5.72	2.95	2.40	2.80	3.28	2.55	3.50	3.12	3.00
9	3.18	3.98	5.95	5.15	2.95	2.40	2.65	3.18	2.52	5.28	3.10	3.00
10	3.08	4.05	6.05	4.80	2.85	2.45	2.60	3.50	2.50	6.15	3.00	2.95
11	3.38	4.15	6.62	4.65	2.80	2.40	2.60	3.25	2.92	5.52	2.95	2.95
12	3.45	4.90	6.55	4.38	2.78	2.78	2.50	3.12	2.98	4.40	3.00	[a]2.90
13	3.38	4.98	5.65	4.25	2.75	3.85	2.52	3.08	2.78	3.85	3.08	.....
14	3.48	4.55	5.18	4.15	2.75	3.30	2.52	2.92	2.62	3.55	3.05	.....
15	3.92	4.30	5.22	4.25	2.72	3.05	2.58	2.78	2.55	3.40	3.00	.....
16	3.95	4.22	5.30	4.25	2.70	2.88	2.60	2.70	2.50	3.20	3.00	.....
17	4.02	4.10	5.65	4.05	2.68	2.78	2.58	2.62	2.50	3.20	3.35	.....
18	3.70	3.55	5.55	3.80	2.62	2.82	2.50	2.60	2.80	5.40	3.98	.....
19	3.55	3.40	6.22	3.68	2.60	2.80	2.50	2.58	2.85	4.85	3.58	.....
20	3.75	3.48	6.50	3.52	2.58	2.75	2.62	2.55	2.75	4.20	3.28	.....
21	3.88	3.58	6.70	3.48	2.55	2.72	2.78	2.60	2.68	3.90	3.25	.....
22	4.25	3.60	6.40	3.38	2.52	3.00	2.80	2.52	2.60	3.50	3.30	.....
23	4.40	3.62	6.02	3.30	2.52	2.98	3.25	2.50	2.50	3.38	3.25	.....
24	4.32	3.75	7.30	3.25	2.55	3.18	2.28	2.45	2.50	3.28	3.35	.....
25	4.20	3.70	5.80	3.18	2.50	3.98	2.95	2.72	2.50	3.20	3.15	.....
26	4.22	3.60	4.90	3.15	2.50	4.65	2.85	3.62	2.45	3.15	3.12	.....
27	3.95	3.60	4.75	3.10	2.50	3.68	2.78	3.15	2.42	3.10	3.15	.....
28	4.05	4.42	5.00	3.08	2.52	3.25	2.68	2.90	2.62	3.10	3.10	.....
29	4.20	.....	4.50	3.02	2.50	3.02	2.72	2.75	2.98	3.08	2.90	.....
30	4.92	.....	4.25	3.02	2.50	2.88	3.72	3.02	2.85	3.05	3.00	.....
31	5.08	.....	4.22	.....	2.48	.....	4.25	3.10	.....	3.05	.....	.....

[a] Stream obstructed by ice.

Readings taken once each week during winter months.

Rating table for Salmon River near Pulaski, N. Y., for open section, from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	110	3.80	965	5.20	3,020	6.60	7,340
2.50	144	3.90	1,060	5.30	3,240	6.70	7,750
2.60	181	4.00	1,170	5.40	3,460	6.80	8,190
2.70	218	4.10	1,300	5.50	3,700	6.90	8,620
2.80	265	4.20	1,420	5.60	3,950	7.00	9,070
2.90	312	4.30	1,450	5.70	4,200	7.10	9,540
3.00	364	4.40	1,680	5.80	4,490	7.20	10,000
3.10	422	4.50	1,830	5.90	4,780	7.30	10,500
3.20	480	4.60	1,980	6.00	5,100	7.40	11,000
3.30	550	4.70	2,140	6.10	5,430	7.50	11,520
3.40	620	4.80	2,300	6.20	5,770	7.60	12,060
3.50	697	4.90	2,470	6.30	6,150	7.70	12,600
3.60	781	5.00	2,640	6.40	6,530		
3.70	865	5.10	2,840	6.50	6,930		

Mean daily discharge, in second-feet, of Salmon River near Pulaski, N. Y., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,940	349	125	620	620	408	241	364	364
2	1,830	364	118	1,230	422	300	451	364	364
3	2,470	144	118	620	300	253	451	312	364
4	6,430	408	110	408	276	218	335	312	312
5	3,820	436	110	323	620	181	655	335	312
6	1,680	378	110	300	620	181	781	697	312
7	1,720	323	110	349	637	162	515	550	364
8	4,270	335	110	265	532	162	697	436	364
9	2,930	335	110	199	465	153	3,190	422	364
10	2,300	288	125	181	697	144	5,520	364	335
11	2,060	265	110	181	515	323	3,760	335	335
12	1,650	253	253	144	436	349	1,680	364	312
13	1,480	241	1,010	153	408	253	1,010	408	(a)
14	1,350	241	550	153	323	190	739	393	.....
15	1,480	229	393	171	253	162	620	364	.....
16	1,480	218	300	181	218	144	480	364	.....
17	1,230	208	253	171	190	144	480	585	.....
18	965	190	276	144	181	265	3,460	1,140	.....
19	844	181	265	144	171	288	2,380	760	.....
20	718	171	241	190	162	241	1,420	532	.....
21	676	162	229	253	181	208	1,070	515	.....
22	602	153	364	265	153	181	697	550	.....
23	550	153	349	515	144	144	602	515	.....
24	515	162	465	532	125	144	532	585	.....
25	465	144	1,140	335	229	144	480	451	.....
26	451	144	2,060	288	802	125	451	436	.....
27	422	144	844	253	451	118	422	451	.....
28	408	153	515	208	312	190	422	422	.....
29	378	144	378	229	241	349	408	312	.....
30	378	144	300	890	378	288	393	364	.....
31	.....	134	.....	1,480	422	.....	393	.....	.....
Mean	1,584	232	382	367	370	214	1,120	466	.....

a From this date river obstructed by ice.

Estimated monthly discharge of Salmon River near Pulaski, N. Y., for 1903.

[Drainage area, 264 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April	6,430	378	1,584	6.000	6.69
May	436	134	232	.879	1.01
June	2,060	110	382	1.447	1.61
July	1,480	144	367	1.391	1.60
August	802	125	370	1.402	1.61
September	408	118	214	.811	.90
October	5,520	241	1,120	4.242	4.89
November	1,140	312	466	1.765	1.97

OSWEGO RIVER NEAR MINETTO, N. Y.

Oswego River is formed by the confluence of Oneida and Seneca rivers at Three River Point. The drainage tributary to the river below the junction of Oneida and Seneca rivers is of small extent. The tributaries are neither large nor numerous, receiving the drainage from a number of small lakes and marshes in a moderately rolling basin. Oneida and Seneca rivers are both noted for their large extent of lake and marsh area. Oneida Lake in the former, and the Finger Lakes tributary to the latter stream afford extensive natural-storage regulation of flow to Oswego River.

A fall of 100 feet in the course of Oswego River is mainly utilized by seven dams, which also partially canalize the stream. The intervening stretches are covered by the Oswego Canal, which draws its water supply from the river. The accompanying tables of daily discharge show the actual flow past the gaging station, not including the flow in Oswego Canal. From the recorded lockage, and from rough measurements of the diversion, the flow in the canal can be estimated. A cable station was established September 14, 1900, 3 miles above Minetto, N. Y., and three-fifths of a mile below the State dam at Battle Island. The cable has a span of 376 feet. The chain gage is located on the left bank 2,930 feet upstream from the cable. It is supported by a framework which projects out over the river. The position of the weight has been referred to a bench mark whose elevation has been assumed as 100 feet. The gage readings are published as elevations referred to this bench mark. The gage is read twice each day by H. L. Woodcock. The bed of the stream at the cable is composed of smooth sandstone.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Oswego River near Minetto, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 13	C. C. Covert	3.82	19,192
May 19	H. H. Halsey	1.20	6,282

Mean daily elevation, in feet, of water surface of Oswego River near Minetto, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	88.30	90.70	93.00	89.00	85.90	87.15	85.10	86.05	85.72	88.15	87.60
2	89.9	88.35	91.10	92.93	88.80	85.48	87.05	84.40	86.15	85.65	88.55	87.53
3	89.05	88.25	90.95	92.85	88.70	85.50	86.70	85.60	86.35	85.40	88.55	87.30
4	88.85	88.25	91.00	93.00	88.92	85.25	86.20	85.25	86.30	84.80	88.43	87.27
5	88.85	88.35	91.05	92.75	88.60	85.25	86.40	85.40	86.30	85.15	88.40	87.20
6	88.75	88.40	91.38	92.85	88.50	85.05	87.07	85.32	85.55	85.70	88.40	87.20
7	88.75	88.55	91.30	92.82	88.30	84.55	86.75	85.35	86.40	85.90	88.35	87.33
8	88.75	88.65	91.25	92.80	88.15	85.70	86.60	85.10	86.32	85.20	88.05	87.55
9	88.65	88.55	92.30	92.90	88.30	85.15	86.70	84.70	86.15	86.70	88.45	87.50
10	88.65	88.65	92.10	92.85	87.75	85.18	86.53	86.20	86.18	87.40	88.30	87.15
11	88.75	88.75	92.40	92.70	88.10	85.10	86.25	85.60	86.30	87.55	87.98	87.20
12	88.75	88.85	92.30	92.55	87.73	85.25	85.62	85.50	86.05	87.80	88.00	87.07
13	88.70	88.85	92.40	92.55	87.60	85.42	85.88	85.45	85.50	88.70	87.83	86.48
14	88.65	88.95	92.45	92.30	87.40	85.05	85.85	85.40	86.40	88.70	87.75	85.85
15	88.65	88.95	92.50	92.30	87.28	86.20	85.70	85.28	86.10	88.70	87.42	86.38
16	88.60	89.05	92.40	92.23	87.15	85.85	85.48	84.65	86.25	88.70	88.25	86.65
17	88.55	89.05	92.50	92.10	86.92	85.92	85.45	85.75	86.00	88.65	87.90	86.40
18	88.55	89.10	92.30	91.80	87.10	85.62	85.45	85.30	86.15	88.97	87.90	86.65
19	88.45	89.15	92.22	91.55	86.78	85.70	85.10	85.20	85.95	89.70	88.00	86.40
20	88.35	89.25	92.15	91.60	86.65	85.55	85.30	85.40	85.35	89.35	88.10	86.70
21	88.30	89.45	92.15	91.30	86.42	85.20	85.30	85.40	85.95	89.35	87.93	87.30
22	88.25	89.58	92.10	91.10	86.22	86.30	85.35	85.25	85.80	89.33	87.85	87.50
23	88.20	89.55	92.97	90.97	86.02	86.45	85.42	84.52	85.75	89.35	88.17	87.90
24	88.15	89.35	93.40	90.70	85.80	86.90	85.40	85.45	85.45	89.10	88.03	87.48
25	88.05	89.40	93.48	90.45	86.60	87.65	85.25	85.22	85.70	88.75	87.95	87.05
26	88.05	89.58	93.40	90.10	86.05	87.75	84.55	85.30	85.40	89.07	88.05	87.23
27	88.15	89.35	93.20	90.20	85.90	87.70	85.70	85.25	85.05	88.85	87.97	87.35
28	88.05	90.05	93.20	89.87	85.90	87.10	85.02	85.35	85.60	88.90	87.95	87.45
29	88.05	.....	93.10	89.70	85.38	87.75	85.20	85.70	85.48	88.83	87.40	87.70
30	88.35	.....	93.15	89.47	85.25	87.25	85.20	85.55	85.60	88.80	87.90	87.75
31	88.30	.....	93.15	.....	84.82	.....	84.85	85.85	.....	88.73	.....	87.85

Mean daily discharge, in second-feet, of Oswego River near Minetto, N. Y., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	8,590	13,690	19,000	10,020	4,290	6,360	3,210	4,510	4,030	8,290	7,210
2	11,930	8,690	14,590	18,860	9,610	3,690	6,170	2,420	4,660	3,930	9,090	7,000
3	10,120	8,490	14,250	18,670	9,400	3,720	5,560	3,860	4,980	3,590	9,090	6,630
4	9,710	8,490	14,360	19,000	9,860	3,400	4,740	3,400	4,900	2,860	8,850	6,590
5	9,710	8,690	14,470	18,420	9,200	3,400	5,050	3,590	4,900	3,270	8,790	6,450
6	9,500	8,790	15,220	18,670	8,990	3,140	6,210	3,490	3,790	4,000	8,790	6,450
7	9,500	9,090	15,040	18,570	8,590	2,580	5,640	3,530	5,050	4,290	8,690	6,690
8	9,500	9,300	14,930	18,550	8,290	4,000	5,380	3,210	4,930	3,340	8,090	7,100
9	9,300	9,090	17,350	18,800	8,590	3,270	5,560	2,740	4,660	5,560	8,890	7,000
10	9,300	9,300	16,870	18,670	7,490	3,310	5,260	4,740	4,710	6,820	8,590	6,360
11	9,500	9,500	17,600	18,300	8,190	3,210	4,820	3,860	4,900	7,100	7,850	6,450
12	9,500	9,710	17,350	17,950	7,450	3,400	3,890	3,720	4,510	7,590	7,990	6,210
13	9,400	9,710	17,600	17,950	7,200	3,620	4,260	3,660	3,720	9,400	7,650	5,180
14	9,300	9,920	17,710	17,350	6,820	3,140	4,220	3,590	5,050	9,400	7,490	4,220
15	9,300	9,920	17,830	17,350	6,590	4,740	4,000	3,440	4,590	9,400	6,850	5,020
16	9,200	10,120	17,600	17,230	6,360	4,220	3,700	2,690	4,820	9,400	8,490	5,470
17	9,090	10,120	17,830	16,870	5,940	4,320	3,660	4,070	4,430	9,300	7,790	5,050
18	9,090	10,230	17,350	16,170	6,260	3,880	3,660	3,460	4,660	9,960	7,790	5,470
19	8,890	10,330	17,160	15,600	5,690	4,000	3,210	3,340	4,360	11,500	7,990	5,050
20	8,690	10,540	16,990	15,720	5,470	3,790	3,460	3,590	3,530	10,750	8,190	5,560
21	8,590	10,960	16,990	15,040	5,060	3,340	3,460	3,590	4,360	10,750	7,850	6,630
22	8,490	11,230	16,870	14,590	4,780	4,900	3,530	3,400	4,150	10,710	7,690	7,000
23	8,390	11,170	18,940	14,300	4,460	5,130	3,620	2,540	4,080	10,750	8,330	7,790
24	8,290	10,750	19,950	13,690	4,150	5,910	3,590	3,660	3,660	10,230	8,050	6,960
25	8,090	10,850	20,100	13,130	5,380	7,300	3,400	3,360	4,000	9,500	7,890	6,170
26	8,090	11,230	19,950	12,370	4,510	7,490	2,580	3,460	3,590	10,160	8,090	6,700
27	8,290	10,750	19,470	12,590	4,290	7,400	4,000	3,400	3,140	9,670	7,930	6,720
28	8,090	12,260	19,470	11,870	4,290	6,260	3,110	3,530	3,860	9,810	7,890	6,910
29	8,090	.....	19,240	11,500	3,570	7,490	3,340	4,000	3,690	9,670	6,820	7,100
30	8,690	.....	19,350	11,000	3,400	6,540	3,340	3,790	3,860	9,610	7,790	7,390
31	8,590	.....	19,350	.....	2,880	.....	2,910	4,220	.....	9,460	.....	7,690
Mean	9,075	9,922	17,273	16,230	6,511	4,496	4,248	3,503	4,335	7,930	8,120	,402

[a] Does not include flow through Oswego Canal.

Estimated monthly discharge of Oswego River near Minetto, N. Y., for 1903.[a]

[Drainage area, 4,990 square miles.]

	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	11,930	8,090	9,075	1.815	2.10
February	12,260	8,490	9,922	1.984	2.06
March	20,100	13,690	17,273	3.455	3.98
April	19,000	11,000	16,260	3.252	3.62
May	10,020	2,880	6,541	1.308	1.51
June	7,490	2,580	4,496	.899	1.00
July	6,360	2,580	4,248	.850	.98
August	4,220	2,420	3,503	.701	.81
September	5,050	3,140	4,335	.867	.97
October	11,500	2,860	7,930	1.586	1.83
November	9,090	6,820	8,120	1.624	1.81
December	7,790	4,220	6,402	1.280	1.48
The year	20,100	2,580	8,175	1.635	22.15

[a] Not including flow through Oswego Canal.

ONEIDA RIVER NEAR EUCLID, N. Y.

Oneida River forms the outlet of Oneida Lake and joins Seneca River at Three River Point to form Oswego River. Owing to the large surface storage in Oneida Lake and in other lakes and swamps within the drainage basin, the flow of the stream is unusually regular. There are two low dams in the stream; the one farther downstream at Oak Orchard is a State dam, having a lock at one end; the upper dam at Caughdenoy consists of five W-shaped barriers or eel weirs, producing a combined fall of 5 feet during low water. Navigation in the stream is maintained by a lock around one end of the weirs. During extreme high water the dams at Oak Orchard and Caughdenoy become entirely submerged. Mud Creek, draining 32 square miles, enters Oneida River between Oak Orchard dam and Schroeppel's bridge. Its drainage area is flat and marshy.

Oneida Lake has a water surface of 80 square miles, and lies at an elevation of 370 feet above sea level. The drainage basin within a radius of 10 miles to the south and west is relatively flat, with numerous marshy tracts. The lake receives, through Chittenango and Oneida creeks, drainage from an extensive area of the central New York plateau, and, through Wood and Fish creeks on the west, drainage from a portion of the west slope of the plateau bordering the Adiron-

dack Mountains. On the north the drainage area is less extensive and the inflowing streams are small. The station was established August 30, 1902, by C. C. Covert. It is located at Schroeppel's bridge, 10 miles north of Syracuse, near Euclid, N. Y. The gage readings are taken from a bulkhead of the lock of the State dam at Oak Orchard, 0.4 mile above Schroeppel's bridge, to avoid as much as possible the effect of backwater at ordinary stages, until its extent can be more definitely ascertained. The gage is read twice each day by Arthur McArthur.

Discharge measurements are made from the downstream side of Schroeppel's five-span bridge. The bridge spans are subdivided into smaller sections during low water by abandoned bridge piers underneath. The initial point for soundings is the downstream side of the left end of the bridge. The channel is straight for 500 feet above and below the station. The current is smooth, steady, and relatively deep. The bed of the stream is composed of clay and small cobblestones, and is regular and permanent. Both banks are high, and the entire flow passes under the bridge at all stages. The bench mark was established by the United States Deep Waterways. It is the top of the lock wall between anchors at the upstream towpath or land side of the gate near a hollow quoin. Its elevation is 369.32 feet above sea level. The reference point on the lock above the dam, at substantially the same elevation as the tide-water bench mark, is itself used as a datum for reference of gage readings.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Oneida River near Euclid, N. Y., in 1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
March 6	C. C. Covert	1.70	7,430
March 7	do	1.63	7,462
April 28	do	2.40	5,595
May 6	do	3.25	3,818
May 9	H. H. Halsey	3.40	3,232
May 12	R. E. Horton	3.56	2,897
May 16	H. H. Halsey	3.80	2,515
Do	do	3.80	2,538
June 25	do	3.15	2,649
June 26	do	3.15	2,618
September 25	do	4.20	1,070
Do	do	4.25	1,043

[a] Distance below top of coping at upper end of lock at dam 0.4 mile above bridge.

Rating table for Oneida River near Euclid, N. Y., from September 1, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.50	13,600	+ .90	9,360	+2.30	5,680	+3.70	2,720
− .40	13,280	+1.00	9,080	+2.40	5,440	+3.80	2,550
− .30	12,960	+1.10	8,810	+2.50	5,190	+3.90	2,380
− .20	12,640	+1.20	8,540	+2.60	4,970	+4.00	2,210
− .10	12,320	+1.30	8,260	+2.70	4,740	+4.10	2,070
+ .00	12,000	+1.40	7,990	+2.80	4,520	+4.20	1,920
+ .10	11,700	+1.50	7,720	+2.90	4,290	+4.30	1,780
+ .20	11,400	+1.60	7,460	+3.00	4,070	+4.40	1,640
+ .30	11,100	+1.70	7,200	+3.10	3,870	+4.50	1,500
+ .40	10,800	+1.80	6,940	+3.20	3,670	+4.60	1,400
+ .50	10,500	+1.90	6,680	+3.30	3,460	+4.70	1,300
+ .60	10,220	+2.00	6,420	+3.40	3,260	+4.80	1,190
+ .70	9,930	+2.10	6,170	+3.50	3,060	+4.90	1,090
+ .80	9,650	+2.20	5,930	+3.60	2,890		

When flash boards are on, gage readings must be reduced by special correction.
From −0.05 to +1.5 is logarithmic extension.
+Gage heights show distance below reference point.
−Gage heights show distance above reference point.

Mean daily discharge, in second-feet, of Oneida River near Euclid, N. Y.,[a] for 1902 and 1903.

Day.	Jan.[b]	Feb.[b]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1									2,070	1,500	2,140	2,230
2									2,070	1,500	2,210	2,230
3									2,070	1,500	2,140	2,300
4									1,920	1,500	2,140	2,370
5									1,780	1,570	2,140	2,300
6									1,920	1,450	2,140	2,230
7									1,920	1,500	2,070	2,230
8									1,920	1,500	2,210	1,870
9									1,920	1,640	2,140	2,080
10									1,850	1,640	2,070	2,300
11									1,780	1,640	2,140	2,300
12									1,780	1,640	2,070	2,370
13									1,780	1,570	2,070	2,370
14									1,640	1,450	2,140	2,370
15									1,640	1,500	2,070	2,370
16									1,640	1,500	2,070	2,370
17									1,640	1,500	2,210	2,370
18									1,640	1,500	2,290	2,540
19									1,640	1,570	2,140	2,630
20									1,640	1,640	2,140	2,880
21									1,500	1,640	2,000	3,050
22									1,450	1,640	1,920	3,140
23									1,400	1,780	2,000	3,420
24									1,500	1,780	2,070	3,720
25									1,500	1,640	2,070	3,830
26									1,500	1,920	2,070	4,030
27									1,500	1,710	2,000	3,830
28									1,400	1,780	1,920	3,930
29									1,400	1,780	2,000	3,930
30									1,400	2,070	2,000	3,930
31										2,070		3,720
Mean									1,694	1,633	2,093	2,814

[a] Low-water discharge, subject to revision. [b] Approximate.

Mean daily discharge, in second-feet, of Oneida River near Euclid, N. Y.,[a] for 1902 and 1903—Continued.

Day.	Jan.[b]	Feb.[b]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	3,320	4,230	5,720	12,160	3,670	1,570	2,380	1,500	1,400	1,090	3,460	2,380
2	3,140	4,030	6,460	12,010	4,410	1,500	2,140	1,500	1,350	1,090	3,460	2,380
3	3,140	4,130	6,710	11,860	4,410	1,500	2,290	1,400	1,350	1,090	3,260	2,290
4	3,620	5,350	7,100	11,860	3,970	1,500	2,290	1,500	1,400	1,090	3,260	2,210
5	3,830	5,600	7,360	11,560	3,770	1,500	2,290	1,400	1,350	1,090	3,060	2,070
6	3,830	6,460	7,360	11,410	3,560	1,500	2,290	1,450	1,350	1,190	2,890	2,070
7	3,830	5,960	7,360	11,260	3,360	1,450	2,290	1,500	1,350	1,240	2,890	2,070
8	3,830	6,580	8,420	11,260	3,260	1,450	2,290	1,400	1,350	1,450	2,720	2,070
9	4,130	7,750	8,970	11,260	3,060	1,400	2,140	1,500	1,350	1,850	2,720	2,070
10	5,350	6,460	9,240	11,110	3,060	1,350	2,070	1,450	1,350	2,380	2,800	1,920
11	5,720	5,840	10,380	10,960	2,890	1,400	2,070	1,450	1,190	2,890	2,890	1,850
12	6,710	5,720	10,810	10,810	2,800	1,450	2,000	1,450	1,240	3,060	2,720	1,780
13	7,100	5,960	11,260	10,520	2,630	1,570	1,920	1,450	1,190	3,160	2,380	1,450
14	6,090	6,210	11,560	10,660	2,550	1,570	1,780	1,400	1,190	3,460	2,380	1,460
15	5,350	5,840	11,560	10,230	2,470	1,570	1,570	1,450	1,190	3,460	2,630	1,610
16	4,680	5,720	11,560	9,670	2,470	1,570	1,500	1,450	1,190	3,670	2,890	1,730
17	4,130	5,470	11,560	9,240	2,380	1,570	1,500	1,350	1,190	3,670	2,470	1,870
18	3,720	7,880	11,560	8,700	2,290	1,570	1,780	1,240	1,190	3,670	2,290	1,940
19	3,720	9,100	11,410	8,290	2,210	1,640	1,640	1,240	1,190	4,180	2,380	2,010
20	3,620	9,240	11,260	8,020	2,140	1,710	2,140	1,190	1,190	4,180	2,630	2,010
21	3,620	9,240	11,260	7,620	2,070	1,920	1,500	1,190	1,190	3,870	2,720	2,010
22	3,720	8,420	11,260	7,230	1,570	2,210	1,450	1,240	1,190	3,870	2,720	2,080
23	3,930	6,970	12,640	6,840	2,070	2,550	1,500	1,350	1,140	3,770	2,630	2,080
24	4,130	5,240	13,440	6,460	2,070	2,800	1,450	1,300	1,090	3,670	2,070	2,080
25	4,230	5,010	13,760	6,210	2,070	2,630	1,450	1,350	1,090	3,570	2,550	2,080
26	4,130	4,790	13,760	5,960	2,000	2,630	1,500	1,350	1,090	3,260	2,550	1,940
27	3,930	4,790	13,760	5,720	1,920	2,630	1,450	1,450	1,500	3,060	2,550	1,940
28	3,520	5,010	13,280	5,470	1,780	2,630	1,450	1,640	990	2,980	2,550	2,010
29	3,420	.....	12,960	5,240	1,710	2,630	1,500	1,850	990	3,060	2,470	2,160
30	2,960	.....	12,800	4,680	1,570	2,630	1,570	1,640	1,090	3,260	2,380	2,230
31	3,320	.....	12,640	.....	1,500	.....	1,500	1,450	.....	3,460	.....	2,370
Mean	4,186	6,179	10,619	9,143	2,635	1,853	1,829	1,422	1,230	2,800	2,712	2,007

[a] Low-water discharge, subject to revision. [b] Approximate.

Estimated monthly discharge of Oneida River near Euclid, N. Y.,[a] in 1902 and 1903.

[Drainage area, 1,400 square miles.]

	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
September	2,070	1,400	1,694	1.21	1.35
October	2,070	1,450	1,633	1.17	1.35
November	2,290	1,920	2,093	1.49	1.66
December	4,030	1,870	2,814	2.01	2.32
1903.					
January	7,100	2,960	4,186	2.99	[b] 3.45
February	9,240	4,030	6,179	4.41	[b] 4.59
March	13,760	5,720	10,619	7.58	8.74
April	12,160	4,680	9,143	6.53	7.28
May	4,410	1,500	2,635	1.88	2.17
June	2,800	1,350	1,853	1.32	1.47
July	2,380	1,450	1,829	1.31	1.51
August	1,850	1,190	1,422	1.02	1.18
September	1,500	990	1,230	.88	.98
October	4,180	1,090	2,800	2.00	2.31
November	3,460	2,070	2,712	1.94	2.16
December	2,380	1,450	2,007	1.43	1.65
The year	13,760	990	3,885	2.77	37.49

[a] Low-water discharge, subject to revision. [b] Record possibly in excess owing to ice.

CHITTENANGO CREEK AT CHITTENANGO, N. Y.

The drainage basin is deeply rolling, mostly cleared, and has a heavy, impervious soil with extensive sodded meadow areas. Cazenovia Lake, which is tributary to Chittenango Creek, is located at an elevation of 1,190 feet. From its outlet to the foot of the plateau at Erie Canal crossing the stream descends 770 feet.

The gaging station was established May 22, 1901, by R. E. Horton. It is located at the Main Street Bridge in the village of Chittenango, N. Y., one-half mile above the State dam, which diverts water for the summit level of Erie Canal. The gage is a vertical board attached to the upstream side of the right abutment. It is read twice each day by Frank A. Sutter. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The bridge has a single span between abutments of 57 feet, and makes an angle of

60 degrees with the direction of the current. The initial point for soundings is the face of the right abutment on the upstream side. The channel is straight for 500 feet above and for 200 feet below the bridge. The banks are subject to overflow only at extreme high water. The bed of the stream is composed of sandy silt and gravel. There is but one channel at all stages. The bench mark is on the upstream corner of the coping of the right abutment. Its elevation is 8.23 feet above the zero of the gage. The drainage area above the gaging station is 79 square miles and above the mouth of the creek is 326 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Chittenango Creek at Chittenango, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 3	C. C. Covert	2.50	276
Do	do	2.48	272
Do	do	2.50	272
March 14	do	2.71	368
March 24	Wm. Nunn	3.02	518
May 1	do	1.80	97
Do	do	1.79	95
May 20	do	1.40	48
Do	do	1.40	49
June 29	H. H. Halsey	1.60	62
Do	do	1.60	62
October 10	Wm. Nunn	3.85	1,000
October 13	do	2.14	183
October 14	do	2.10	177

Mean daily gage height, in feet, of Chittenango Creek at Chittenango, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.18	2.20	3.10	2.55	1.90	1.40	1.55	1.40	1.80	1.50	2.00	1.85
2	2.18	2.20	2.70	2.50	1.80	1.40	1.50	1.40	1.60	1.50	1.90	1.80
3	2.40	2.60	2.50	2.50	1.70	1.40	1.50	1.40	1.55	1.40	1.90	1.70
4	2.38	3.30	2.40	2.80	1.55	1.40	1.50	1.40	1.45	1.40	1.90	1.70
5	2.38	2.95	2.55	2.40	1.50	1.40	1.50	1.40	1.40	1.40	2.00	1.70
6	2.28	2.60	2.60	2.40	1.50	1.40	1.70	1.40	1.40	1.40	2.00	1.70
7	2.25	2.50	2.50	2.55	1.50	1.40	1.50	1.60	1.40	1.40	1.90	1.65
8	2.20	2.40	2.95	2.70	1.50	1.40	1.50	1.55	1.40	1.75	1.90	1.60
9	2.05	2.40	3.55	2.60	1.50	1.40	1.50	1.40	1.40	2.70	1.90	1.60
10	2.00	2.32	3.10	2.60	1.50	1.40	1.50	1.40	1.40	4.05	1.90	1.60
11	2.00	2.40	3.65	2.50	1.50	1.40	1.50	1.40	1.40	3.70	1.80	1.55
12	2.00	2.65	3.05	2.50	1.50	2.10	1.50	1.40	1.40	2.40	1.80	1.50
13	2.00	2.60	2.95	2.50	1.50	1.70	1.50	1.40	1.40	2.15	1.80	1.50
14	2.00	2.40	2.75	2.40	1.50	1.45	1.50	1.40	1.40	2.10	1.80	1.50
15	2.00	2.30	2.55	2.40	1.50	1.55	1.50	1.40	1.40	2.10	1.80	1.50
16	2.00	2.30	2.55	2.35	1.50	1.60	1.50	1.40	1.40	2.10	1.80	1.60
17	2.00	2.20	2.55	2.30	1.50	1.60	1.50	1.40	1.40	2.15	2.35	1.50
18	1.90	2.20	2.50	2.30	1.50	1.60	1.50	1.40	1.40	3.10	2.20	1.50
19	1.90	2.10	2.40	2.20	1.50	1.60	1.50	1.40	1.40	2.90	1.95	1.80
20	1.90	2.10	2.35	2.20	1.50	1.70	1.50	1.90	1.40	2.70	1.90	1.80
21	2.10	2.15	2.30	2.15	1.50	2.10	1.50	1.50	1.40	2.30	1.90	2.00
22	2.00	2.20	2.65	2.10	1.50	1.90	1.55	1.40	1.40	2.30	1.90	1.90
23	2.00	2.10	3.50	2.05	1.50	1.75	1.80	1.40	1.40	2.20	1.90	1.80
24	2.12	2.10	3.08	2.00	1.50	1.70	1.60	1.40	1.40	2.20	1.20	1.80
25	1.95	2.10	2.85	2.00	1.45	2.00	1.50	1.80	1.40	2.10	1.90	1.80
26	1.95	2.10	2.60	2.00	1.40	1.95	1.50	2.00	1.40	2.05	1.90	1.70
27	1.90	2.05	2.60	2.00	1.40	1.80	1.40	1.70	1.40	2.00	1.90	1.60
28	1.95	3.85	2.60	1.95	1.40	1.60	1.40	1.40	1.40	2.15	1.90	1.80
29	2.40	.....	2.55	1.90	1.40	1.55	1.40	2.05	1.40	2.20	1.90	1.80
30	3.30	.....	2.50	1.90	1.40	1.60	1.40	1.85	1.40	2.12	1.80	1.80
31	2.30	.....	3.00	.....	1.40	.....	1.40	1.80	.....	2.00	.....	1.80

Rating table for Chittenango Creek at Chittenango, N. Y., for open section, from May 22 to December 15, 1901.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	10	2.00	90	2.70	332	3.40	713
1.40	16	2.10	116	2.80	379	3.50	774
1.50	22	2.20	142	2.90	430	3.60	838
1.60	32	2.30	172	3.00	480	3.70	901
1.70	42	2.40	208	3.10	536	3.80	968
1.80	56	2.50	244	3.20	594	3.90	1,040
1.90	73	2.60	288	3.30	652	4.00	1,110

Rating table for Chittenango Creek at Chittenango, N. Y., for open section, from December 16, 1901, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	16	2.30	210	3.60	846	4.90	1,870
1.05	19	2.35	226	3.65	876	4.95	1,920
1.10	22	2.40	242	3.70	906	5.00	1,970
1.15	26	2.45	259	3.75	936	5.05	2,020
1.20	29	2.50	276	3.80	968	5.10	2,080
1.25	32	2.55	297	3.85	1,000	5.15	2,130
1.30	36	2.60	318	3.90	1,030	5.20	2,190
1.35	41	2.65	338	3.95	1,060	5.25	2,240
1.40	45	2.70	359	4.00	1,100	5.30	2,300
1.45	50	2.75	380	4.05	1,130	5.35	2,350
1.50	54	2.80	405	4.10	1,170	5.40	2,410
1.55	60	2.85	430	4.15	1,210	5.45	2,460
1.60	66	2.90	454	4.20	1,240	5.50	2,520
1.65	72	2.95	479	4.25	1,280	5.55	2,580
1.70	78	3.00	504	4.30	1,320	5.60	2,640
1.75	84	3.05	531	4.35	1,370	5.65	2,710
1.80	93	3.10	558	4.40	1,410	5.70	2,770
1.85	102	3.15	586	4.45	1,460	5.75	2,830
1.90	111	3.20	613	4.50	1,500	5.80	2,900
1.95	120	3.25	640	4.55	1,550	5.85	2,960
2.00	130	3.30	669	4.60	1,590	5.90	3,030
2.05	143	3.35	698	4.65	1,640	5.95	3,090
2.10	155	3.40	728	4.70	1,680	6.00	3,160
2.15	168	3.45	757	4.75	1,730		
2.20	180	3.50	786	4.80	1,780		
2.25	193	3.55	816	4.85	1,830		

Discharge above 4-foot gage height deduced by extension of rating curve on logarithmic section paper.

Mean daily discharge, in second-feet, of Chittenango Creek at Chittenango, N. Y., 1901–1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1						288	73	48	82	52	56	77
2						379	73	48	82	52	56	155
3						235	64	56	64	52	56	208
4						191	64	56	52	52	61	56
5						172	90	56	56	52	64	64
6						148	116	61	56	52	61	64
7						404	103	73	45	48	64	64
8						299	73	69	42	52	64	64
9						226	73	61	42	52	64	82
10						155	73	64	56	52	69	682
11						129	73	48	56	52	56	208
12						136	73	73	52	52	103	164
13						116	56	73	64	52	90	148
14						103	56	73	52	52	56	(a)
15						90	48	73	48	52	56	(a)
16						90	56	64	48	52	90	968
17						90	64	69	56	52	56	728
18						82	56	56	52	56	56	669
19						82	56	64	61	61	56	504
20						343	56	73	52	56	56	259
21						467	56	73	61	52	56	242
22					90	244	56	73	52	52	56	142
23					217	404	56	73	52	61	56	130
24					129	208	56	77	52	64	61	130
25					116	142	61	56	52	64	110	130
26					97	142	56	64	52	64	82	130
27					116	116	48	64	48	64	69	130
28					155	90	42	64	48	61	90	130
29					235	90	42	64	48	61	73	136
30					310	73	69	69	52	56	73	130
31					288	.....	61	73	.....	56	.....	130
Mean					175	191	64	65	54	55	67	232

a Record not available.

Mean daily discharge, in second-feet, of Chittenango Creek at Chittenango, N. Y., 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	130	93	1,922	210	78	102	193	226	50	111	111	84
2	130	93	1,638	210	78	93	130	259	72	168	111	84
3	130	1,132	1,170	180	78	130	276	180	66	111	111	130
4	130	404	786	180	78	876	210	155	66	111	130	93
5	130	454	504	210	78	359	242	130	66	111	180	93
6	120	318	210	210	78	242	370	504	66	155	180	93
7	102	318	259	210	78	180	404	242	60	180	180	93
8	93	210	318	180	78	276	276	259	54	193	168	93
9	78	130	318	454	78	276	210	193	72	180	155	84
10	78	102	318	531	78	318	318	180	142	155	102	84
11	78	78	380	318	72	380	226	180	78	155	102	84
12	78	78	1,132	318	66	454	155	155	66	142	120	93
13	78	78	1,324	318	66	276	130	130	54	120	111	93
14	78	78	669	276	66	226	180	120	54	102	111	93
15	78	78	558	276	66	430	193	111	78	84	130	93
16	78	78	558	218	66	380	180	102	78	102	130	226
17	78	78	1,324	180	66	259	142	111	78	130	120	210
18	78	78	669	180	66	180	130	111	78	155	111	180
19	78	78	404	180	78	162	130	111	78	218	111	186
20	78	78	318	180	93	155	338	102	78	111	93	180
21	78	78	318	155	84	180	338	93	78	84	93	180
22	102	93	404	130	78	155	640	93	78	84	93	586
23	93	78	404	111	78	130	276	84	72	102	93	359
24	78	78	276	111	78	111	226	78	66	111	93	276
25	78	78	276	111	93	111	168	78	66	111	72	210
26	78	78	276	111	168	180	155	78	111	111	72	210
27	130	78	242	93	93	142	640	66	111	111	78	180
28	111	786	242	93	102	111	404	66	111	558	84	180
29	93	.....	242	78	155	120	259	54	102	259	84	180
30	93	.....	242	78	155	155	180	54	93	155	84	180
31	93	.....	242	.....	130	.....	180	54	.....	120	.....	180
Mean	94	192	579	203	87	238	256	141	77	148	114	164

Mean daily discharge, in second-feet, of Chittenango Creek at Chittenango, N. Y., 1901–1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	174	180	558	296	111	45	60	45	93	54	130	102
2	174	180	359	276	93	45	54	45	66	54	111	93
3	242	318	276	276	78	45	54	45	60	45	111	78
4	234	669	242	404	60	45	54	45	50	45	111	78
5	234	479	296	242	54	45	54	45	45	45	130	78
6	201	318	318	242	54	45	78	45	45	45	130	78
7	193	276	276	296	54	45	54	66	45	45	111	72
8	180	242	479	359	54	45	54	60	45	84	111	66
9	142	242	816	318	54	45	54	45	45	359	111	66
10	130	218	558	318	54	45	54	45	45	1,132	111	66
11	130	242	876	276	54	45	54	45	45	906	93	60
12	130	338	531	276	54	155	54	45	45	242	93	54
13	130	318	479	276	54	78	54	45	45	168	93	54
14	130	242	380	242	54	50	54	45	45	155	93	54
15	130	210	296	242	54	60	54	45	45	155	93	54
16	130	210	296	226	54	66	54	45	45	155	93	66
17	130	180	296	210	54	66	54	45	45	168	226	54
18	111	180	276	210	54	66	54	45	45	558	180	54
19	111	155	242	180	54	66	54	45	45	454	120	93
20	111	155	226	180	54	78	54	111	45	359	111	93
21	155	168	210	168	54	155	54	54	45	210	111	130
22	130	180	338	155	54	111	60	45	45	210	111	111
23	130	155	786	142	54	84	93	45	45	180	111	93
24	162	155	544	130	54	78	66	45	45	180	155	93
25	120	155	430	130	50	130	54	93	45	155	111	93
26	120	155	318	130	45	120	54	130	45	142	111	78
27	111	142	318	130	45	93	45	78	45	130	111	66
28	120	984	318	120	45	66	45	45	45	168	111	93
29	242	.....	296	111	45	60	45	142	45	180	111	93
30	669	.....	276	111	45	66	45	102	45	162	93	93
31	210	.....	504	.....	45	.....	45	93	.....	130	.....	93
Mean	171	266	400	222	56	71	55	60	48	228	117	79

Estimated monthly discharge of Chittenango Creek at Chittenango, N. Y., for 1901–1903.

[Drainage area, 79 square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.[b]
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
May 22–31	310	90	175	2.222	2.56	5.79
June	467	73	191	2.426	2.72	5.62
July	116	42	64	.813	.94	3.33
August	77	48	65	.826	.95	3.87
September	82	42	54	.686	.77	2.86
October	64	48	55	.698	.80	2.32
November	110	56	67	.851	.95	3.47
December	([a])	56	232	2.946	3.39	4.93
1902.						
January	130	78	94	1.194	1.37	1.48
February	1,132	78	192	2.438	2.54	3.94
March	1,922	210	579	7.353	8.46	3.36
April	531	78	203	2.578	2.88	1.96
May	168	66	87	1.105	1.27	3.75
June	876	93	238	3.022	3.38	6.18
July	640	130	256	3.251	3.74	7.12
August	504	54	141	1.791	2.06	3.65
September	142	50	77	.978	1.09	2.50
October	558	84	148	1.880	2.16	4.83
November	180	72	114	1.448	1.62	1.62
December	586	84	164	2.083	2.40	4.25
The year	1,922	50	191	2.427	32.97	44.64
1903.						
January	669	111	171	2.172	2.50	2.96
February	984	142	266	3.378	3.52	2.59
March	876	210	400	5.080	5.84	4.69
April	404	111	222	2.819	3.15	2.08
May	111	45	56	.711	.82	.11
June	155	45	71	.902	1.00	8.76
July	93	45	55	.698	.80	1.24
August	142	45	60	.762	.88	5.19
September	93	45	48	.610	.68	1.34
October	1,132	45	228	2.900	3.33	7.78
November	226	93	117	1.486	1.66	2.24
December	130	54	79	1.003	1.15	3.36
The year	1,132	45	148	1.877	25.33	42.34

[a] Not available; flood, December 14–15, 1901. [b] Mean of Bouksville and Fayetteville records.

SENECA RIVER AT BALDWINSVILLE, N. Y.

This station was established November 12, 1898, by Geo. W. Rafter. It is located at the State dam at Baldwinsville, N. Y., 12 miles above the junction of Seneca River with Oneida River. The discharge over the dam when the flashboards are not in place is computed by the formula for a broad, flat-crested weir. The discharge over the flashboards is computed by the Francis formula. A gage in the river channel below the dam is read to determine the average working head on the turbines. The discharge through the three main canals is determined from records, which are kept in each mill, of the run of the water wheels, and from the recorded lockage and the opening of the paddles at the Oswego Canal lock at the foot of the canal. The current-meter measurements made during 1903 to determine the amount of leakage at the several mills show that these amounts are larger than was previously estimated. The discharge at the new bridge at Belgium, N. Y., June 27, 1903, was 3,817 second-feet. The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Seneca River at Baldwinsville, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,430	4,450	4,600	9,080	5,870	2,890	3,330	1,310	2,660	2,470	4,390	3,860
2	3,380	5,680	5,900	8,850	5,850	2,700	3,100	1,020	2,860	2,470	5,110	3,650
3	3,710	5,510	6,050	8,920	4,630	2,630	2,960	2,690	3,080	2,510	4,880	3,660
4	3,310	6,060	6,070	9,100	5,780	2,700	2,250	1,710	3,240	2,000	4,770	3,530
5	4,530	6,340	6,520	8,070	5,540	2,600	2,180	1,550	3,290	2,610	4,560	3,430
6	4,770	6,680	6,760	8,800	5,310	2,520	2,850	1,530	2,890	2,590	4,440	3,140
7	4,660	6,660	6,820	9,110	5,290	1,550	2,780	1,610	3,190	2,590	4,350	3,510
8	4,590	5,240	6,170	9,220	5,200	2,810	2,950	2,000	3,250	2,800	3,910	3,280
9	4,210	6,610	7,370	9,190	5,100	2,670	2,850	1,710	3,270	3,000	4,530	3,090
10	3,880	6,400	7,220	9,360	4,120	2,560	2,830	2,030	3,230	3,370	4,440	2,960
11	3,030	6,350	7,540	9,000	5,110	2,520	2,520	1,960	3,250	3,450	4,330	2,840
12	3,080	6,300	7,660	8,370	4,870	2,680	1,910	1,950	3,320	4,250	4,440	2,820
13	2,350	6,530	7,800	8,890	4,850	2,770	2,300	2,010	2,830	4,360	4,440	2,890
14	2,710	6,360	7,870	8,660	4,630	1,820	2,150	1,840	2,790	4,430	4,050	4,750
15	2,890	5,280	7,000	8,520	4,510	3,240	1,870	1,770	3,060	4,480	3,640	2,770
16	2,890	5,740	8,290	8,440	4,350	3,000	1,770	1,370	3,170	4,450	3,860	2,300
17	3,100	4,200	7,970	8,300	3,170	3,000	1,870	1,920	3,000	4,620	3,900	2,130
18	2,490	4,430	8,000	8,170	4,280	3,000	1,500	1,730	3,280	4,340	4,320	2,140
19	3,060	3,800	7,990	7,820	3,960	2,840	1,270	1,760	3,050	5,260	4,560	2,150
20	2,950	4,180	7,590	8,010	3,990	2,210	1,870	1,940	2,810	5,210	4,370	2,010
21	3,050	4,100	7,570	7,750	3,790	1,930	1,840	2,030	3,250	5,210	4,370	2,170
22	2,940	3,530	6,710	7,660	3,990	2,480	1,770	1,950	3,160	5,210	3,880	2,600
23	3,080	4,490	7,990	7,520	3,690	2,520	1,780	1,450	3,080	5,320	4,420	2,780
24	2,920	4,230	8,520	7,280	2,540	2,710	1,700	2,130	2,870	5,290	4,440	2,770
25	2,560	4,770	8,790	6,790	3,800	3,260	1,470	1,860	2,650	4,860	4,380	2,840
26	3,450	4,630	8,910	5,700	3,270	3,490	1,260	1,930	2,590	5,450	3,910	2,940
27	3,170	4,760	9,060	6,510	3,200	3,570	1,770	1,940	2,530	5,070	4,330	2,440
28	3,170	5,390	8,850	6,140	3,000	3,090	1,380	1,990	2,670	5,040	3,870	2,150
29	3,390	.....	8,100	6,220	2,180	3,530	1,410	1,810	2,520	5,070	3,410	2,020
30	4,620	.....	9,140	6,080	2,400	3,490	1,590	1,570	2,430	4,810	3,810	2,090
31	4,860	.....	9,010	.....	1,740	.....	1,510	2,310	.....	4,800	.....	2,230
Mean	3,427	5,311	7,546	8,051	4,194	2,759	2,084	1,819	2,976	4,109	4,277	2,837

Estimated monthly discharge of Seneca River at Baldwinsville, N. Y., for 1903.

[Drainage area, 3,103 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,860	2,350	3,427	1.10	1.27
February	6,680	3,530	5,311	1.71	1.78
March	9,140	4,690	7,546	2.43	2.80
April	9,360	5,700	8,051	2.59	2.89
May	5,870	1,740	4,194	1.35	1.56
June	3,570	1,550	2,759	.89	.99
July	3,330	1,260	2,084	.67	.77
August	2,690	1,020	1,819	.59	.68
September	3,320	2,430	2,976	.96	1.07
October	5,450	2,000	4,109	1.32	1.52
November	5,110	3,410	4,277	1.38	1.54
December	4,750	2,010	2,837	.91	1.05
The year	9,360	1,020	4,116	1.32	16.14

SKANEATELES OUTLET AT WILLOW GLEN, N. Y.

Skaneateles Lake is the fifth in size of the Finger Lakes tributary to Seneca River. The surface of the lake is at an elevation of 865 feet above sea level. The outlet descends 465 feet from Skaneateles village to the Erie Canal crossing near Jordan, a distance of 12 miles, and enters Seneca River above Cross Lake. The average width of the land surface on the two sides of the lake is 2½ miles. In this distance occurs a rise of 400 to 800 feet, the greater portion being within 1 mile of the lake on either side. The surface inflow takes place through numerous short lateral feeders flowing down these slopes. The daily discharge over a thin-edged weir, located in the village of Willow Glen, 1½ miles below the foot of Skaneateles Lake, has been observed, beginning March 10, 1895. The weir has a crest length of 27 feet, with two end contractions. The discharge is computed from the observed depth on a stake set with its top at crest level 5.2 feet upstream from the weir. The Francis formula is used, including corrections for end contractions and velocity of approach. Beginning July 1, 1894, the water supply of the city of Syracuse has been drawn from Skaneateles Lake, and the amount of its diversion should be added to the discharge over Willow Glen weir to obtain the total run-off from the drainage basin. The computed diversion, as determined from the record of gate openings and head at the inlet

gates, using the formula for orifices with a constant coefficient of 0.62, has been furnished by the city of Syracuse. The observations were taken at the weir and gates by Edward Conron.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Skaneateles Lake outlet at Willow Glen, N. Y., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	80.0	82.8	80.0	91.2	122.1	116.2	97.2	103.4	109.8	109.8	122.7	97.2
2	80.0	80.0	85.5	94.2	116.2	116.2	97.2	103.4	109.8	113.0	122.7	91.2
3	80.0	82.8	82.8	103.4	116.2	116.2	97.2	103.4	109.8	109.8	122.7	91.2
4	80.0	82.8	82.8	116.2	116.2	116.2	97.2	106.6	129.2	109.8	122.7	91.2
5	80.0	85.5	82.8	116.2	116.2	116.2	97.2	106.6	129.2	109.8	122.7	91.2
6	80.0	85.5	82.8	116.2	116.2	116.2	103.4	109.8	129.2	109.8	122.7	91.2
7	80.0	82.8	82.8	122.7	116.2	109.8	97.2	122.7	129.2	109.8	122.7	91.2
8	80.0	82.8	88.3	171.2	116.2	109.8	97.2	109.8	129.2	122.7	116.2	91.2
9	80.0	82.8	97.2	171.2	116.2	109.8	97.2	109.8	113.0	132.5	109.8	91.2
10	80.0	82.8	88.3	178.9	116.2	103.4	119.4	109.8	109.8	149.5	109.8	91.2
11	80.0	82.8	100.3	175.0	116.2	103.4	119.4	106.6	116.2	122.7	109.8	91.2
12	80.0	85.5	94.2	156.6	116.2	109.8	122.7	103.4	113.0	113.0	109.8	91.2
13	80.0	82.8	91.2	142.5	116.2	109.8	122.7	103.4	109.8	113.0	109.8	91.2
14	80.0	82.8	85.5	142.5	116.2	109.8	122.7	103.4	109.8	113.0	109.8	91.2
15	80.0	82.8	85.5	156.6	116.2	109.8	122.7	103.4	109.8	113.0	109.8	91.2
16	80.0	82.8	85.5	178.9	116.2	109.8	122.7	103.4	109.8	109.8	109.8	91.2
17	80.0	80.0	88.3	178.9	116.2	109.8	122.7	103.4	109.8	122.7	116.2	91.2
18	80.0	80.0	85.5	178.9	116.2	109.8	122.7	103.4	109.8	132.5	109.8	91.2
19	80.0	80.0	85.5	178.9	116.2	109.8	122.7	103.4	109.8	129.2	109.8	91.2
20	80.0	80.0	85.5	171.2	116.2	109.8	122.7	109.8	109.8	129.2	109.8	94.2
21	80.0	80.0	91.2	171.2	116.2	109.8	122.7	109.8	109.8	129.2	109.8	91.2
22	80.0	80.0	91.2	171.2	116.2	109.8	129.2	106.6	109.8	129.2	109.8	91.2
23	80.0	80.0	129.2	163.8	116.2	116.2	129.2	103.4	109.8	129.2	109.8	91.2
24	80.0	80.0	116.2	163.8	116.2	103.4	122.7	103.4	109.8	129.2	109.8	91.2
25	80.0	80.0	116.2	163.8	116.2	103.4	122.7	116.2	109.8	129.2	109.8	91.2
26	80.0	80.0	91.2	163.8	116.2	103.4	103.4	119.4	109.8	129.2	109.8	91.2
27	80.0	80.0	91.2	149.5	116.2	103.4	103.4	109.8	109.8	129.2	109.8	91.2
28	80.0	80.0	91.2	135.8	116.2	103.4	103.4	116.2	109.8	132.5	109.8	91.2
29	80.0	.....	91.2	135.8	116.2	97.2	103.4	116.2	109.8	132.5	109.8	91.2
30	82.8	.....	103.4	135.8	116.2	97.2	103.4	116.2	109.8	129.2	103.4	91.2
31	85.5	.....	97.2	.....	116.2	.....	103.4	109.8	.....	129.2	.....	91.2
Mean	80.2	81.8	91.9	149.8	116.4	109.0	112.0	108.2	113.4	122.7	113.0	91.4

Estimated monthly discharge of Skaneateles Lake outlet at Willow Glen, N. Y.,[a] for 1903.

[Drainage area, 742 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	85.5	80.0	80.2	1.08	1.25
February	85.5	80.0	81.8	1.10	1.14
March	129.2	80.0	91.9	1.24	1.43
April	178.9	91.2	149.8	2.02	2.25
May	121.1	116.2	116.4	1.57	1.81
June	116.2	97.2	109.0	1.47	1.64
July	129.2	97.2	112.0	1.51	1.74
August	122.7	103.4	108.2	1.46	1.68
September	129.2	109.8	113.4	1.53	1.71
October	149.5	109.8	122.7	1.66	1.91
November	122.7	103.4	113.0	1.52	1.70
December	97.2	91.2	91.4	1.23	1.42
The year	149.5	80.0	107.5	1.48	19.68

[a] Actual flow in outlet, not including diversion.

Estimated monthly discharge of Skaneateles Lake outlet at Willow Glen, N. Y.,[a] for 1902 and 1903.

[Drainage area, 742 square miles.]

Month.	Mean discharge in second-feet.	Run-off.	
		Second-feet per square mile.	Depth in inches.
1902.			
October	136.4	1.84	2.12
November	131.6	1.78	1.99
December	103.2	1.39	1.60
1903.			
January	99.0	1.33	1.53
February	100.4	1.37	1.42
March	111.3	1.50	1.73
April	168.2	2.27	2.53
May	136.4	1.84	2.12
June	129.2	1.74	1.94
July	132.0	1.78	2.05
August	128.2	1.73	1.99
September	132.8	1.79	2.00
October	143.0	1.93	2.23

[a] Including diversion for water supply of Syracuse.

GENESEE RIVER AT ROCHESTER, N. Y.

During the low-water season of 1903 a series of current-meter measurements were made in the Carroll and Fitzhugh and in the Johnson and Seymour raceways, which receive their water supply from the Johnson and Seymour dam on Genesee River in Rochester. The stage of the water was below the crest of the dam at all times during the period while measurements were being taken, with the exceptions noted on the tables. The measurements were taken late in the afternoon or early in the morning, the water being drawn down to the minimum stage, and they therefore represent, as nearly as could be obtained, the natural low-water flow of the stream at this point. The Johnson and Seymour dam is of masonry, practically water-tight. It is located below the point of diversion from Genesee River to the Erie Canal feeder, and the pond above the dam receives only the water supply available to the extensive power development at the three falls on the river, which occur within the city limits.

A record of the daily stage of Genesee River in the pond, measured at a point 15 feet upstream from Johnson and Seymour dam, has been kept, beginning March, 1893. A survey and profile of the dam have also been made. From these data the high-water discharge can be calculated.

In addition to the canal feeder mentioned, water is diverted from Allen Creek at Scottsville and brought down the abandoned Genesee Valley Canal for the supply of Erie Canal at Rochester. The water supply of the city of Rochester is also drawn from Hemlock Lake, the outlet of which is tributary to Genesee River.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Genesee River at Rochester, N. Y.[a]

Date.	Hydrographer.	Fitzhugh and Carroll raceway.			Johnson and Seymour raceway.			Total discharge.
		Gage height. (b)	Elevation water surface.	Discharge.	Gage height. (c)	Elevation water surface.	Discharge.	
1903.		*Feet.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Feet.*	*Sec.-ft.*	*Sec.-ft.*
July 23	C. C. Covert	3.00	241.10	340	.....	.....	.....	340
July 25	do	.....	.....	.....	4.24	241.08	306	306
July 27	do	1.94	240.04	279	3.55	240.39	362	641
July 27	E. H. Fisher	.....	.....	.....	3.08	239.92	331	331
July 28	do	1.74	239.84	237	3.48	240.32	281	518
July 30	do	2.95	241.05	237	2.95	239.79	236	473
July 31	do	1.32	239.42	232	2.58	239.42	286	518
Aug. 1	do	.....	.....	.....	2.78	239.62	305	305
Aug. 3	do	2.00	240.10	271	2.98	239.82	394	665
Aug. 12	do	3.45	241.55	350	3.92	240.76	428	778
Aug. 13	do	3.35	241.45	332	3.68	240.52	450	782
Aug. 14	do	2.90	241.00	371	3.98	240.82	450	821
Aug. 15	do	2.45	240.55	245	3.48	240.32	373	618
Aug. 17	do	1.50	239.60	278	2.82	239.66	383	661
Aug. 18	do	1.08	239.18	214	2.40	239.24	298	512
Aug. 19	do	.68	238.78	268	2.18	239.02	278	546
Aug. 20	do	.82	238.92	276	3.32	240.16	282	558
Aug. 21	do	3.30	241.40	383	4.10	240.94	428	811
Aug. 22	do	3.22	241.32	271	3.98	240.82	396	667
Sept. 24	do	1.60	239.70	343	2.78	239.62	295	638
Sept. 26	do	1.20	239.30	208	2.38	239.22	245	453
Sept. 29	do	.30	238.40	273	1.98	238.82	206	479
Sept. 30	do	.55	238.65	258	2.15	238.99	240	498
Oct. 2	do	.12	238.22	252	1.95	238.79	232	484
Oct. 3	do	.88	238.98	241	1.98	238.82	208	449
Oct. 5	do	2.95	241.05	347	3.98	240.82	339	686
Oct. 6	do	.....	.....	.....	3.90	240.74	264	264
Oct. 30	do	2.05	240.15	364	3.10	239.94	312	676
Oct. 31	do	1.60	239.70	350	3.35	240.19	318	668
Nov. 2	do	1.72	239.82	363	3.45	240.29	252	615
Nov. 3	do	1.50	239.60	320	3.35	240.19	314	634
Nov. 4	do	.65	238.75	299	2.20	239.04	202	501
Nov. 9	do	3.45	241.55	142	.....	.....	.....	142
Nov. 10	do	.....	.....	.....	4.20	240.04	404	404
Nov. 13	do	3.35	241.45	256	.....	.....	.....	256

[a] Pond filled during night and water flowed over dam in morning during period of measurements only between July 25 and 27 and August 5 and 14, inclusive.
[b] Elevation gage zero 238.10, city datum.
[c] Elevation gage zero 236.84, city datum.

Flood discharge of Genessee River at Rochester, N. Y., 1894.

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
May 19	3,823	1.62	May 31	5,793	2.45
May 20	9,943	4.20	June 1	6,673	2.82
May 21	14,753	6.26	June 2	9,823	3.31
May 22	21,273	9.01	June 3	9,823	4.15
May 23	28,053	11.88	June 4	10,873	4.61
May 24	24,973	10.57	June 5	8,663	3.66
May 25	21,273	9.01	June 6	6,343	2.68
May 26	18,023	7.61	June 7	5,273	2.23
May 27	15,313	6.47	June 8	4,523	1.91
May 28	10,323	4.36	June 9	4,123	1.74
May 29	8,573	3.63	June 10	3,823	1.62
May 30	7,343	3.10	June 11	3,253	1.37

Flood discharge of Genesee River at Johnston and Seymore's dam, Rochester, N. Y., 1896.

Date.	Time.	Second-feet.	Second-feet per square mile.
March 26		3,073	1.30
March 27		6,643	2.81
March 28		8,373	3.54
March 29		9,423	3.98
March 30		20,763	8.80
March 31		26,723	11.29
April 1	8:30 a. m.	32,663	13.83
April 1	12:10 p. m.	35,783	15.14
April 1	11:30 p. m.	35,963	15.23
April 2	9 a. m.	35,223	14.89
April 2	12 p. m.	34,873	14.76
April 3	8:30 a. m.	30,463	12.90
April 4		24,743	10.45
April 5		19,023	8.04
April 6		11,463	4.86
April 7		8,643	3.65
April 8		6,943	2.94
April 9		5,773	2.44
April 10		5,623	2.38
April 11		6,763	2.86
April 12		7,073	2.99
April 13		7,483	3.16
April 14		11,173	4.74
April 15		11,063	4.70
April 16		9,073	3.84
April 17		6,783	2.87
April 18		5,723	2.42
April 19		6,125	2.59
April 20		4,823	2.04
April 21		3,943	1.67
April 22		3,503	1.48
April 23		3,223	1.36

Flood discharge of Genesee River at Rochester, N. Y., 1900.

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
April 14	9,523	4.03	April 22	18,873	7.99
April 15	8,023	3.39	April 23	23,563	9.98
April 16	6,663	2.82	April 24	24,173	10.24
April 17	5,943	2.51	April 25	22,623	9.56
April 18	5,263	2.22	April 26	18,873	7.99
April 19	4,793	2.03	April 27	13,193	5.58
April 20	4,793	2.03	April 28	7,223	3.05
April 21	11,573	4.91	April 29	5,423	2.29

Flood discharge of Genesee River at Rochester, N. Y., 1901.

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
March 12	5,423	2.29	March 29	22,623	9.56
March 13	7,823	3.31	March 30	19,693	8.33
March 14	7,223	3.05	March 31	12,493	5.29
March 15	7,023	2.97	April 1	7,423	3.14
March 16	6,473	2.74	April 2	5,423	2.29
March 17	5,423	2.29	April 3	5,123	2.17
March 18	4,943	2.09	April 4	6,663	2.82
March 19	6,123	2.59	April 5	8,423	3.56
March 20	9,523	4.03	April 6	12,023	5.08
March 21	11,323	4.78	April 7	15,163	6.43
March 22	14,923	6.30	April 8	16,973	7.19
March 23	12,873	5.46	April 9	17,623	7.44
March 24	10,113	4.27	April 10	17,663	7.49
March 25	12,493	5.29	April 11	14,923	6.30
March 26	17,023	7.19	April 12	12,723	5.37
March 27	19,983	8.46	April 13	10,873	4.61
March 28	22,623	9.56			

Flood discharge of Genesee River at Johnston and Seymour dam, Rochester, N. Y., 1902.

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
February 28	2,883	1.22	March 12	9,323	3.94
March 1	19,143	8.08	March 13	14,663	6.22
March 2	33,873	14.34	March 14	15,423	6.51
March 3	36,523	15.44	March 15	14,923	6.30
March 4	33,343	14.09	March 16	10,173	4.31
March 5	27,073	11.46	March 17	12,023	5.08
March 6	20,273	8.59	March 18	13,923	5.88
March 7	10,623	4.48	March 19	6,823	2.88
March 8	7,423	3.14	March 20	4,793	2.03
March 9	7,023	2.97	March 21	4,083	1.73
March 10	8,023	3.39	March 22	3,973	1.68
March 11	7,423	3.14			

Flood discharge of Genesee River at Rochester, N. Y.

[Drainage area, 2,365 square miles.]

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
Mar. 13, 1893 [a]	16,343	6.89	Jan. 22, 1900	16,573	7.02
Dec. 18, 1893	16,483	6.97	Mar. 26, 1900	12,953	5.50
Mar. 9, 1894	20,123	8.50	Nov. 27, 1900	15,843	6.68
Apr. 25, 1894	15,073	6.39	Mar. 28–29, 1901	22,623	9.56
May 23, 1894	28,283	11.97	Apr. 24, 1901	24,173	10.24
Apr. 11, 1895	15,873	6.73	Dec. 16–18, 1901	14,883	6.30
Apr. 1, 1896	35,963	15.23	Mar. 3, 1902	36,523	15.44
Mar. 12, 1897	15,323	6.47	July 23, 1902	14,723	6.22
Mar. 31, 1898	12,493	5.29	Dec. 24, 1902	10,623	4.48
Dec. 25, 1898	13,593	5.92	Feb. 6, 1903	15,163	6.43
Jan. 6, 1899	13,593	5.92	Mar. 10, 1903	16,973	7.19
Mar. 6, 1899	10,743	4.53	Apr. 5, 1903	18,383	7.78

[a] 1,123 second-feet added flow in raceways.

HONEOYE CREEK AT EAST RUSH, N. Y.

This station was established February 13, 1903. It is located at Smith's mill in the village of East Rush, N. Y. The record includes the flow over the dam and the discharge through two Leffel standard turbines, one 48 inches and the other 35 inches in diameter. The dam is built of timber and has a crest varying somewhat in elevation

and 150 feet long. A record is kept of the head on the turbines, the number of hours each runs per day, and the average gate opening. The gate opening is obtained by noting the number of gear teeth out of the total possible number through which the wheel-gate stems may be turned to open the gates, allowance being made for lost motion.

Honeoye Creek is the outlet of Honeoye Lake which forms one of a group of narrow parallel lakes similar to the Finger Lakes of the Seneca River basin. It is joined 4 miles below its source by the combined outlet of Hemlock and Canadice lakes, which enters Genesee River near Rochester Junction. The lakes, which act as natural reservoirs, have inlets draining considerable areas at their uppermost ends. The slopes adjacent to the lakes themselves are narrow and steep, and are drained by gulleys and torrential brooks. The area below the lakes is rolling, with rich and extensively cultivated soil. The stream tributaries are not numerous, but ramify in such manner as to give good drainage to all portions of the area. The diversion from Hemlock Lake by the city of Rochester is to be added to the measured run-off at East Rush to obtain the total yield of the drainage basin. These data are not now available, but the average diversion rate is about 22 cubic feet per second. The discharge at the gaging station in 1903 has not been computed.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Drainage areas of Honeoye Creek.[a]

	Sq. miles.
Hemlock Lake, above outlet	47
Canadice Lake, above outlet	13
Canadice Lake outlet to Hemlock Lake outlet	31
Junction of Hemlock and Canadice Lake outlets	78
Hemlock outlet, from junction to Honeoye Creek	94
Honeoye Lake, above outlet	40
Honeoye Creek, from Lake outlet, to junction of Hemlock outlet	71
Honeoye and Hemlock outlets at junction	165
Honeoye Creek junction to Honeoye Falls	209
Honeoye Falls to East Rush	260
Honeoye Creek, East Rush, to mouth	288

HEMLOCK LAKE AT HEMLOCK, N. Y.

The point of gaging by the Rochester water department is immediately below the foot of the lake, which receives the drainage from an area 2½ miles wide and 7 miles long, through the center of which lies the lake itself, together with that from a rectangular area 5 miles square tributary to the inlet stream at the head of the lake. The side slopes rise to an elevation of 500 to 1,000 feet above the lake.

[a] From U. S. Geol. Survey topographic maps.

in a distance of 1 to 1½ miles on either side. These slopes give rise to very few perennial streams. The inlet at the head of the lake drains a dissected plateau tapped by numerous branching tributaries.

One-third mile below the foot of the lake the outlet is joined by that of Canadice Lake, and the combined discharge enters Honeoye Creek after a course of 5 miles.

A record of the elevation of the water surface in the lake has been maintained by the water department of the city of Rochester since June, 1876. The monthly mean elevations to the end of 1895 are given in the accompanying table.

It is stated that the outlet of the lake was retained in a uniform, natural condition for a long period prior to 1895. In 1895 a submerged weir was constructed in the outlet, forming a channel, the width of which could be varied at will. From then to the present date the rate of discharge at a given stage has depended upon the condition of this weir.

In 1860 a company was formed for the purpose of bringing a gravity water supply to Rochester from Hemlock Lake. In April, 1872, a board of water commissioners was created by the city of Rochester, the rights of the original water company were obtained, and early in 1876 a conduit, consisting of 9.75 miles of 36-inch riveted wrought-iron pipe and 18 miles of 24-inch cast-iron pipe, was completed from Hemlock Lake to the Mount Hope distributing reservoir at Rochester.

In October, 1894, a second conduit of 38-inch steel and 36-inch cast-iron pipe was completed.

In connection with gagings of the Hemlock Lake outlet, the diversion through these conduits has been determined by using the reservoir at Rush, located midway between Hemlock Lake and Rochester, for a volumetric measure of the flow.

Early in the fall of 1895 a measuring flume which controlled the outflow from the lake was constructed below the gates. This flume is 96 feet in length, consisting of a plank channel with bottom elevation of −1, side slopes of 1½ to 1, and bottom width of 26 feet. Eight feet upstream from the lower end of the channel, a submerged weir 0.98 foot high, with a crest 2 inches wide, is placed across the channel. Vertical stop planks or needles are provided, by means of which the opening at the weir can be contracted to a width of 10 feet. Bridges are placed across the stream above and below the measuring channel. The discharge is determined by means of rod floats timed by stop watch, the mean position, of course, of each float being also recorded. Painted, round, wooden rods, weighted nearly to submergence, of various lengths adapted to the depth of the channel, are used. The floats are run through a course of 15 to 25 feet. The mean velocity of the water in each vertical plane is assumed to be the same as that of the float. From 100 to 200 or more float runs are included in each

discharge measurement. From these a curve of mean velocity in a horizontal plane is obtained and the discharge computed.[a]

The results of gagings which have been made, (1) with the full width of the measuring flume, representing the natural outflow from the channel; and (2) with the contracted weir, are given in the accompanying tables. The method of gaging was devised by Emil Kuichling, C. E., and the discharge measurements have been made by John F. Skinner, C. E. Variation in area of section and discharge at a given stage is produced by changing the width of the submerged weir.

In the following tables is given the estimated mean annual diversion since the completion of the first conduit; also the monthly mean diversion, beginning 1894, determined from the gagings.

The history and results of gaging of the conduits may be found in the following:

(1) Report of J. T. Fanning and Alphonse Fteley, consulting engineers on additional water supply. Rochester Executive Board, 1890, pages 30 to 60.

(2) Review and discussion of the above-named report by J. Nelson Tubbs, chief engineer Rochester waterworks. Rochester Executive Board, 1890, pages 63 to 94.

(3) Rochester Executive Board, 1891. Report of Emil Kuichling on the original and present discharging capacity and diminution in same of the old Hemlock Lake conduit, pages 32 to 39.

(4) Summary of gagings of the old Hemlock Lake conduit. Rochester Executive Board, 1894–95, page 169.

(5) Comparison of the original computations and actual gagings of the new steel conduit. Emil Kuichling, C. E. Report Rochester Executive Board, 1894–95, pages 340 to 351.

(6) Gagings of the new Hemlock Lake conduit, by E. Kuichling. Rochester Executive Board, 1897, pages 41 to 44.

(7) Gagings of the new Hemlock Lake conduit, by E. Kuichling. Rochester Executive Board, 1898, pages 34 to 35.

(8) Gagings of the old and new Hemlock Lake conduits. Rochester Executive Board, 1899, pages 35 to 36.

(9) Summary of gagings of Hemlock Lake conduits for years 1897–1901. Rochester, Department of Public Works, 1901, pages 171 to 174.

(10) One hundred and fifteen hydraulic experiments. Clemens Herschel, pages 1 to 26.

(11) Hydraulics of the Hemlock Lake conduit of the Rochester waterworks. Geo. W. Rafter, Translator American Society Civil Engineers, volume 26, pages 13 to 22.

(12) Measures for restricting the use and waste of water in force in the city of Rochester, N. Y. George W. Rafter, Translator American Society Civil Engineers, volume 26, pages 23 to 76.

[a] See paper by John F. Skinner, C. E., Methods of gaging of Hemlock Lake outlet; Trans. Cornell University Soc. Civil Eng., 1897-98, p. 144.

Rod float measurements[a] of discharge of outlet of Hemlock Lake, N. Y.[b]

Date.	Elevation of lake.	Mean cross section of channel.	Discharge.
		Square feet.	*Second-feet.*
1897.			
April 15	1.808	69.2	43.14
May 15	1.573	60.0	36.22
May 24	1.362	53.0	29.92
June 1	1.111	44.9	23.78
June 8	.932	43.2	18.32
June 16	.737	36.1	13.79
June 22	.562	37.0	9.13
1898.			
April 2	1.816	83.9	42.44
April 8	1.686	79.5	33.41
April 12	1.581	76.4	31.67
April 16	1.494	73.7	25.31
April 26	1.869	85.6	44.26
May 2	1.739	81.5	39.39
May 14	1.622	78.1	35.36
May 18	1.535	74.8	30.17
June 2	1.401	70.4	23.85
June 6	1.273	66.4	19.50
June 10	1.157	62.2	15.61
June 16	1.054	58.9	13.29
July 6	.753	49.5	6.85
July 11	.566	43.9	4.02
July 14	.480	41.1	3.16
1899.			
January 21	1.663	60.8	43.63
April 19	1.669	79.1	38.66
April 26	1.502	74.1	30.80
May 11	1.284	66.5	22.48
May 25	.994	57.0	16.91
1900.			
April 6	2.248	97.5	67.75
April 11	2.261	98.2	74.67
May 2	1.772	81.8	41.19
1901.			
April 2	2.420	104.0	80.63
May 1	2.344	102.7	77.97
May 8	2.092	93.9	60.16
May 14	2.281	100.5	72.37
May 21	1.979	90.1	50.31

[a] Submerged weir, 10 feet long.
[b] Report Rochester, N. Y., Department of Public Works, 1901, p. 175.

Rod float measurements[a] *of discharge of outlet, Hemlock Lake, N. Y.*[b]

Date.	Elevation of lake.	Mean cross section of channel.	Discharge.
		Square feet.	*Second-feet.*
1897.			
April 17	1.868	76.7	61.83
April 24	1.618	66.2	44.28
May 20	1.422	59.3	38.79
June 3	1.080	46.2	25.74
June 8	.932	44.7	21.19
June 16	.737	36.6	15.34
June 22	.562	35.3	10.33
1898.			
March 26	1.494	75.4	36.59
April 2	1.816	83.9	59.27
April 8	1.686	79.1	44.51
April 12	1.581	76.3	37.43
April 16	1.494	73.4	30.03
April 26	1.869	85.6	63.39
May 2	1.739	84.5	54.89
May 14	1.622	78.0	43.47
May 18	1.535	75.0	35.73
June 2	1.401	70.4	26.67
June 6	1.273	66.7	22.79
June 10	1.157	63.1	17.72
June 16	1.054	59.0	12.79
June 27	1.005	57.7	12.57
July 6	.753	50.1	7.27
July 11	.566	44.5	4.32
July 14	.480	41.2	3.72
1899.			
January 21	1.663	59.3	53.63
April 19	1.669	79.1	45.68
April 26	1.502	73.4	36.22
May 11	1.284	66.1	26.99
May 25	.994	57.1	18.59
1900.			
April 5	2.143	92.8	90.10
April 11	2.266	96.9	113.13
May 2	1.769	81.6	53.25
May 19	1.578	74.7	32.69

[a] Submerged weir, full width of channel.
[b] Report Rochester, N. Y., Department of Public Works, 1901, p. 174.

Rod float measurements of discharge of outlet, Hemlock Lake, N. Y.—Continued.

Date.	Elevation of lake.	Mean cross section of channel.	Discharge.
1901.		*Square feet.*	*Second-feet.*
March 29	2.960	117.1	250.68
April 2	2.420	102.0	141.09
April 11	2.879	116.1	240.98
April 16	2.610	108.2	181.37
April 23	3.243	126.3	341.76
April 25	3.057	120.9	287.98
May 1	2.366	100.8	126.46
May 8	2.086	92.8	84.00
May 14	2.236	97.6	89.44
May 21	1.980	89.5	67.02

Mean monthly elevation of surface of Hemlock Lake, N. Y.[a]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year.
1876	.....	.....	.....	.....	.....	+1.283	+1.202	+0.557	+0.410	+0.900	+0.722	+0.422	[b]+0.785
1877	- 0.055	-0.114	+0.934	+1.515	+1.275	+ .907	+ .651	+ .611	+ .053	- .486	+ .048	+ .339	+ .473
1878	+ .788	+1.559	+1.778	+1.664	+1.255	+1.122	+ .918	+ .648	+ .228	- .292	+ .111	+1.529	+ .942
1879	+1.004	+ .733	+1.219	+1.624	+1.026	+ .362	+ .097	- .452	-1.086	-1.610	-1.867	-1.672	- .052
1880	- .910	- .112	+ .212	+ .792	+ .865	+ .447	- .147	- .696	-1.130	-1.567	-1.238	-1.332	- .401
1881	-1.467	- .113	+1.198	+1.466	+1.323	+1.081	+ .579	.000	- .691	- .811	- .708	- .051	+ .151
1882	+1.632	+1.392	+1.674	+1.512	+1.609	+1.452	+ .813	+ .150	- .437	- .985	-1.377	-1.513	+ .494
1883	-1.599	+ .031	+ .945	+1.569	+1.585	+1.375	+1.290	+ .643	+ .249	+ .072	+ .167	+ .442	+ .567
1884	+ .460	+1.281	+1.465	+1.561	+1.622	+1.014	+ .575	+ .273	- .256	- .695	-1.168	-1.392	+ .395
1885	-1.258	-1.364	-1.524	+ .882	+1.373	+1.121	+ .987	+ .291	- .006	- .295	- .261	+ .410	+ .030
1886	+1.253	+1.318	+1.096	+1.592	+1.131	+ .554	+ .013	- .422	- .524	-1.282	- .902	+ .376	+ .350
1887	+ .588	+1.673	+1.484	+1.421	+1.654	+1.039	+ .475	+ .056	- .386	- .631	-1.037	-1.097	+ .437
1888	- .883	- .712	+ .517	+1.985	+1.454	+1.357	+ .394	- .181	- .683	- .956	-1.030	- .555	+ .059
1889	+ .918	+1.250	+1.410	+1.493	+1.365	+1.945	+1.257	+ .669	+ .099	+ .267	+1.152	+1.289	+1.093
1890	+1.316	+1.197	+1.517	+1.620	+1.001	+1.755	+ .724	+ .236	+1.195	+1.123	+1.465	+1.176	+1.277
1891	+1.496	+2.031	+1.637	+1.516	+ .904	+ .542	+ .172	- .135	- .221	- .620	- .875	- .402	+ .504
1892	+ .493	+ .821	+1.287	+1.658	+1.597	+1.527	+1.277	+ .668	+ .217	- .195	- .134	+ .433	+ .804
1893	+ .346	+ .789	+1.728	+2.049	+2.308	+1.382	+ .824	+ .277	+ .692	+ .433	+ .137	+ .384	+ .946
1894	+1.177	+1.301	+1.778	+1.854	+1.719	+1.695	+ .679	- .070	- .387	- .570	- .459	-1.788	+ .628
1895	- .998	- .860	+ .309	+1.580	+1.055	+ .333	- .325	- .856	-1.378	-2.172	-2.653	-2.790	- .730

[a] Annual Report Executive Board, Rochester, N. Y., 1894-95, p. 222. Referred to Rochester water works datum.

[b] Average for seven months.

Mean monthly diversion, in second-feet,[a] from Hemlock Lake, N. Y.[b]

Month.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	11.30	12.71	15.97	17.11	16.36	17.68	18.21	19.40	20.90
February	10.15	14.96	16.42	17.51	16.45	19.74	19.70	20.47	21.70
March	10.40	15.07	15.38	16.88	16.24	18.47	19.20	20.06	21.15
April	10.79	12.69	15.78	16.81	16.40	18.26	18.31	19.80	20.90
May	10.09	14.35	15.72	17.94	16.82	17.52	18.92	20.07	20.78
June	10.73	16.18	15.54	16.85	18.09	18.83	20.53	21.13	20.77
July	11.10	18.52	16.88	16.21	19.33	18.72	20.02	21.91	20.30
August	10.51	16.17	16.48	16.10	18.34	20.72	20.01	21.36	21.50
September	11.52	15.98	15.00	15.79	18.09	18.23	19.43	20.65	22.90
October	12.12	15.69	14.96	16.24	16.72	17.90	18.80	20.06	20.30
November	11.66	14.93	16.12	16.60	16.94	18.00	18.23	20.54	20.46
December	11.86	15.31	15.71	16.20	17.03	18.42	19.29	20.34	21.86
The year	11.07	15.22	15.88	16.70	17.24	18.96	19.22	20.48	21.10

[a] Includes losses due to leakage and evaporation in Rush and Mount Hope reservoirs.
[b] Report Department of Public Works, Rochester, N. Y., 1901, p. 181.

Mean annual diversion from Hemlock Lake, N. Y.[a]

Year.	Gallons per 24 hours.	Second-feet.	Year.	Gallons per 24 hours.	Second-feet.
1879	[b]4,000,000	[b]6.20	1891	[b]6,800,000	10.54
1880	4,341,100	6.73	1892	[b]7,000,000	10.85
1881	4,238,100	6.57	1893	7,460,000	11.56
1882	4,528,900	7.02	1894	7,469,800	11.58
1883	4,817,100	7.47	1895	9,819,200	15.22
1884	5,348,800	8.29	1896	10,241,900	15.88
1885	5,128,900	7.95	1897	10,771,000	16.70
1886	5,773,700	8.94	1898	11,122,500	17.24
1887	[b]5,980,000	9.27	1899	12,022,900	18.96
1888	[b]6,185,000	9.59	1900	12,398,222	19.20
1889	[b]6,390,000	9.90	1901	13,214,079	20.50
1890	[b]6,595,000	10.23	1902	13,640,405	21.10

[a] From Annual Report Executive Board, Rochester, N. Y., 1899, p. 41, etc.
[b] Estimated.

NOTE.—The above figures for the consumption from the Hemlock Lake (gravity) system include the losses by evaporation and leakage from the reservoir.

GENESEE RIVER NEAR MOUNT MORRIS, N. Y.

The course of Genesee River below Mount Morris is very winding, traversing from side to side a flood plain 1½ miles in average width. The Cuba reservoir of the Genesee-Allegheny divide receives the drainage from a tributary area of 26.6 square miles. The storage volume is 454,000,000 cubic feet, including Rockville reservoir. The overflow from this reservoir enters Allegheny River. The storage water may be turned into the summit level of the abandoned Genesee Valley Canal, and thence into Genesee River.

The gaging station is located a short distance below the inflow of Canaseraga Creek. It was established May 22, 1903, and is located at Jones's highway bridge. The standard chain gage is secured to the truss uprights near the middle of the main bridge span on the upstream side. It is read twice each day by J. T. Trewer. Discharge measurements are made from the footway on the downstream side of the bridge, which consists of a main span of 174 feet and a shorter span of 32 feet. The channel is straight for several hundred feet below the station. About 300 feet above there is an abrupt bend in the channel.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Genesee River near Mount Morris, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 23	C. C. Covert	4.66	311
Do	do	4.66	295
June 13	H. H. Halsey	4.90	419
Do	do	4.90	430
July 25	C. C. Covert	4.92	520
October 3	H. H. Halsey	5.12	572

Mean daily gage height, in feet, of Genesee River near Mount Morris, N. Y., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.50	5.50	4.02	9.07	4.52	4.72	5.42
2	.....	4.45	5.15	4.87	7.82	4.57	4.72	5.32
3	.....	4.45	5.00	4.67	6.82	5.17	4.72	5.07
4	.....	4.45	4.95	4.82	6.22	4.97	4.62	5.02
5	.....	4.45	4.95	8.62	5.72	4.87	4.72	5.02
6	.....	4.45	5.15	8.37	5.47	7.07	4.77	5.07
7	.....	4.35	5.95	6.82	5.32	5.87	5.07	4.87
8	.....	4.35	5.35	6.12	5.27	5.52	4.87	4.92
9	.....	4.40	5.00	5.67	4.52	13.52	4.87	4.92
10	.....	4.55	4.85	5.57	4.32	8.82	4.77	4.82
11	.....	4.65	4.75	5.47	5.47	7.37	4.82	4.87
12	.....	4.80	4.75	5.17	7.17	7.12	4.72	4.67
13	.....	4.85	4.75	5.07	5.87	6.52	4.72	5.02
14	.....	4.90	4.75	4.92	5.37	6.02	4.72	6.87
15	.....	4.85	4.65	4.77	5.27	5.72	4.72	7.67
16	.....	4.80	4.65	4.62	5.02	5.52	4.82	7.42
17	.....	4.80	4.60	4.57	5.32	5.42	9.17	7.32
18	.....	4.80	4.55	4.52	6.57	5.37	14.22	7.17
19	.....	4.70	4.62	4.52	6.02	6.47	9.47	6.92
20	.....	4.65	5.02	5.92	5.37	5.92	7.72	6.82
21	.....	5.20	4.97	5.27	5.12	5.52	7.12	6.62
22	4.70	6.75	5.02	5.12	5.02	5.32	6.67	6.67
23	4.70	6.05	5.27	4.82	4.82	5.22	6.32	6.52
24	4.60	7.10	5.67	4.62	4.72	5.12	6.72	6.52
25	4.55	6.95	5.12	5.02	4.62	5.12	6.57	6.42
26	4.60	7.90	4.87	5.02	4.57	5.02	6.17	6.47
27	4.60	6.80	4.77	4.77	4.42	4.9	5.72	6.52
28	4.70	5.95	4.62	4.67	4.52	4.92	5.62	6.72
29	4.80	5.70	4.62	16.07	4.57	4.97	5.62	6.62
30	4.80	5.70	4.52	13.57	4.42	4.87	5.62	6.72
31	4.65	.....	4.57	10.67	.....	4.87	.....	6.57

OAK ORCHARD CREEK AND TONAWANDA FEEDER NEAR MEDINA, N. Y.

Oak Orchard Creek drains a swampy plateau having an elevation of 600 to 650 feet, lying in an easterly and westerly direction, south of Medina and Albion, N. Y.

At the western border of this swamp the stream turns north, crosses Erie Canal at Medina, and enters Lake Ontario at Point Breeze. The original Tonawanda Swamp has three outlets, the eastern end draining into Sandy Creek near Holly, N. Y., and the western end being tributary to Tonawanda Creek.

In 1824 a channel was cut from Tonawanda Creek across the western end of the Tonawanda Swamp, entering Oak Orchard Creek, the object being to divert a portion of the flow of Tonawanda Creek to feed the long level of Erie Canal extending from Lockport to Rochester. This feeder channel intercepts the drainage from a portion of Tonawanda Creek drainage basin, including Whitney Creek, a small tributary. The flow from the diverting dam on Tonawanda Creek into the feeder

channel is controlled by gates and is cut off, except during the season of canal navigation.

The upland basin of Oak Orchard Creek is slightly rolling, has a compact clay soil, is nearly devoid of timber land, and is under a high state of cultivation. The swamp itself has a clay or gravel hardpan overlain with a few feet of peaty, black muck. The swamp is practically covered with a growth of hard-wood swamp timber. The upland is underlain by soft, argillaceous shales, at no great depth, in the region south of Medina. A barrier of hard limestone crosses the stream below the swamp outlet in the vicinity of Shelby. At Shelby the stream makes a descent of approximately 80 feet over a ledge of the limestone barrier, encountering lower down in its course the Medina sandstone, and making a further descent of approximately 100 feet at Medina.

Tonawanda Swamp affords a large surface-storage area, but owing to the restricted outlet of the stream the floods are severe. The low-water flow is sustained by the gradual lowering of the ground water in the swamp area and to some extent by the contribution of springs from the pervious strata of Helderberg limestone forming the southerly divide of the basin.

The diverting channel from Tonawanda Creek has a total length of 107,712 feet, in which occurs a fall of 30.1 feet. It was the original intention in 1823 to utilize this channel to draw off a portion of the flood waters of Tonawanda Creek, for use later in regulating the lower navigable portion of the stream. The diverting channel was designed to have a bottom width of 70 feet, but has never been constructed to this capacity. The right of way is said to have been provided by the Holland Land Company, which was largely benefited by the reclamation of extensive swamp areas bordering, and by the creation of valuable water-power privileges, which have since been developed in the vicinity of Medina. The feeder channel is used at the present time as the outlet of numerous farm drains from the adjoining flats.

Water brought from lower Tonawanda Creek and from Lake Erie through the Erie Canal is passed over the waste weir at Medina, entering Oak Orchard Creek. The amount thus diverted to the drainage basin at times greatly exceeds that taken from Oak Orchard Creek feeder for the supply of the canal; hence, the importance of the stream for water-power purposes is chiefly confined to its lower course of about 18 miles, from Medina to its mouth. In this distance occurs a fall of 250 feet. The stream flows throughout much of the distance through a gulf cut in the drift overlying the Medina sandstone and affording a narrow flood plain.

A temporary gaging station was established on Oak Orchard Creek at Coon's bridge for the department of the attorney-general of New York, May 16, 1903.

Coon's bridge is located 6 miles from Medina, along stream, and is just below the junction of Tonawanda feeder and the so-called Acker ditch, an artificial channel 2 miles in length leading Oak Orchard Creek into the lower end of the feeder channel. The bridge has a single span of 60.8 feet between vertical masonry abutments. The low-water flow is confined in a central channel about 25 feet in width with hard, gravel bed and smooth, uniform current, this channel having been excavated by New York State in 1894. A low-water gage, reading from zero to 4.5 feet, is attached vertically to a braced post underneath the downstream side of the bridge and at the right-hand side of the low-water channel.

The stream bends about 100 feet above the bridge, but is straight below it, and the current passes underneath normal to the bridge. The remaining channel, unoccupied by the low-water course, is covered with silt and sand, with numerous willow bushes.

A secondary flood channel, having a width of 26 feet between abutments, is situated 283 feet to the right of the main bridge. Water also flows over a highway between the two bridges in extreme freshets.

The high water of 1894 reached an elevation of 612.5 feet above the State datum. This was previous to the improvement. The water surface, March 4, 1903, was at an elevation of 610.98 feet, corresponding to a gage reading of 7.76 feet.

During low water no water passes from the head of the Acker ditch through the natural channel of Oak Orchard Creek, the flow at Coon's bridge being made up of the discharge of Oak Orchard Creek proper, the inversion from Tonawanda Creek to the feeder, the inflow from Whitney Creek and the portion of Tonawanda swamp intercepted by the feeder, the drainage from the swamp, and the inflow from farm drains to the feeder within Oak Orchard watershed.

Measurements of the slight inflow from Whitney Creek and other sources were made May 16 to 21 by means of floats in a straight, uniform section of the feeder, 50 feet in length, having its head 750 feet upstream from the gage. The gage reader at Coon's bridge is Rolla Dunlap.

The accompanying table shows a summary of gagings made to show the relative discharge of Oak Orchard Creek proper and of Oak Orchard Creek combined with the flow in the channel of the feeder itself and of Whitney Creek. The flow in Oak Orchard Creek was obtained at the Acker Farm bridge, about 800 feet upstream from Coon's bridge.

In determining the discharge in the feeder at Lewiston road, water-soaked floats were used, which would remain just submerged, and were timed in groups of two or three each at intervals of 2 feet across the stream. Soundings at intervals of 1 foot were taken in those sections 10 feet apart. There was no wind during the progress of the meas-

urements, and no slack water at the sides of measuring section. The bed of the channel is of soft clay silt.

The discharge of Whitney Creek was determined by current meter, checked by means of floats in a narrow, deep section having hard clay bed, situated about 1,000 feet above the mouth of the stream.

Discharge of Oak Orchard Creek and feeder.

Date.	Flow in feeder.	Discharge of Whitney Creek.[a]		Outflow from swamp.
1903.	*Second-feet.*	*Second-feet.*	*Sec.-ft. per sq. mile.*	*Second-feet.*
May 16	1.52	0.90	0.117	30.6
May 17	1.22	.78	.101	28.4
May 18	1.85	1.09	.142	30.0
July 21	19.68			

[a] Drainage area, 7.67 square miles.

Drainage areas of Oak Orchard Creek.

	Sq. miles.
Above Coons bridge	142.6
Above Medina feeder dam	150.7
Above Ridgeway	158.2
Above mouth	281.9
Swamp area	32.0
Swamp area, per cent, above Coon's bridge	22.4
Tonawanda Creek, above diverting dam	236.3

Discharge measurements of Oak Orchard Creek at Coon's bridge, near Medina, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 16	R. E. Horton	[a]1.40	[a]33
May 17	do	1.33	32
May 18	do	1.30	30
June 14	H. H. Halsey	.95	17
Do	do	.95	17
July 22	C. C. Covert	1.225	19
July 24	do	1.20	19
Do	do	1.20	20

[a] Referred to new gage. Original gage 1 foot higher.

Discharge measurements of Oak Orchard Feeder at Lewiston Road, near Medina, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 16	R. E. Horton	0.61	[a] 1.5
May 17	do	.61	1.2
May 18	do	.61	1.8
July 21	C. C. Covert	1.60	19.7

[a] Made by surface floats, 2-foot intervals, 50-foot course.

Mean daily gage height, in feet, of Oak Orchard Creek at Coon's bridge near Medina, N. Y., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.15	1.50	1.12	2.00	1.30	1.30	1.25
2	.....	1.08	1.38	1.10	1.85	1.30	1.25	1.30
3	.....	1.02	1.38	1.10	1.72	1.30	1.22	1.25
4	.....	[a] 1.00	1.35	2.30	1.68	1.20	1.25	1.30
5	.....	1.00	1.35	2.82	1.75	1.12	1.30	1.30
6	.....	.95	1.45	2.30	1.60	1.30	1.25	1.35
7	.....	.85	1.40	2.15	1.70	1.38	1.30	1.42
8	.....	1.00	1.37	2.05	1.70	1.48	1.48	1.48
9	.....	1.00	1.30	2.10	1.70	1.50	1.50	1.42
10	.....	1.00	1.30	2.40	1.85	1.50	1.45	1.50
11	.....	1.00	1.30	2.22	1.80	1.50	1.42	1.50
12	.....	1.00	1.20	2.05	1.75	1.50	1.48	1.50
13	.....	.90	1.10	1.85	1.70	1.50	1.48	1.65
14	.....	1.00	1.10	1.72	1.68	1.50	1.48	1.50
15	.....	1.00	1.18	1.48	1.62	1.50	1.48	1.48
16	.....	1.00	1.18	1.35	1.60	1.50	1.50	1.50
17	1.30	1.00	1.18	1.28	1.60	1.45	1.52	1.60
18	1.30	1.00	1.18	1.18	1.60	1.50	1.70	1.65
19	1.25	1.00	1.20	1.10	1.60	1.50	1.60	1.62
20	1.20	1.00	1.20	.50	1.55	1.48	1.72	1.70
21	1.50	1.00	1.15	.80	1.40	1.45	1.45	1.72
22	1.48	1.00	1.22	.75	1.40	1.40	1.40	1.70
23	1.40	1.00	1.22	1.00	1.40	1.40	1.38	1.78
24	1.40	1.00	1.22	.95	1.38	1.38	1.40	2.00
25	1.30	1.00	1.18	1.08	1.40	1.35	1.35	2.00
26	1.30	1.00	1.12	1.05	1.22	1.32	1.40	2.05
27	1.30	1.00	1.10	1.00	1.30	1.32	1.32	2.10
28	1.32	1.00	1.08	1.05	1.25	1.32	1.30	2.02
29	1.30	1.00	1.08	1.10	1.28	1.30	1.30	2.00
30	1.25	1.05	1.75	1.62	1.30	1.30	1.30	1.90
31	1.20	.....	1.40	1.95	.....	1.30	.....	1.90

[a] Approximate, June 4 to 30, 1903.

MISCELLANEOUS MEASUREMENTS IN THE LAKE ONTARIO DRAINAGE.

Oak Orchard Creek, Ridgeway bridge below Erie Canal, May 18, 1903, by R. E. Horton and C. C. Covert; water surface, 9.15 feet below coping, downstream right-hand abutment; discharge, 159.7 second-feet or 1.009 second-feet per square mile from 158.2 square miles; 0.41 inch rainfall during thirty days preceding.

Tonawanda Creek, Indian bridge above feeder, May 17, 1903, by R. E. Horton and C. C. Covert; water surface, 15.55 feet below top downstream right-hand abutment; discharge, 47 second-feet, or 0.205 second-foot per square mile from 228.8 square miles; 0.41 inch rain during thirty days preceding.

LAKE ERIE DRAINAGE BASIN.

The Lake Erie drainage basin is conspicuous by the lack of any large streams which flow through it, this being due to the comparatively short distance from the lake to the divide between it and its adjacent drainage areas. The largest stream is the Maumee, which is formed in the northeast part of Indiana by the junction of the St. Joseph and St. Mary rivers, and flows northeast, entering Lake Erie in the northwest corner of Ohio.

Following is a list of the stations maintained during 1903 in the Lake Erie drainage:

Cuyahoga River at Cleveland, Ohio.
Cuyahoga River at Independence, Ohio.
Ohio and Erie Canal at Cleveland, Ohio.
Black River near Elyria, Ohio.
Tiffin River near Defiance, Ohio.
Auglaize River near Defiance, Ohio.
Blanchard River at Ottawa, Ohio.
Ottawa River at Lima, Ohio.
Maumee River near Sherwood, Ohio.

CUYAHOGA RIVER AT CLEVELAND, OHIO.

This station was originally established May 25, 1903, by R. Winthrop Pratt. It was located at the terminal division Baltimore and Ohio Railroad bridge, about 4 miles south of the post-office at Brooklyn. The gage consisted of a 1 by 6 inch board nailed to old piles on the north side of the river, 20 feet above the bridge. The bench mark was a notch on the southeast corner of the south abutment. Its elevation was 14.5 feet above the zero of the gage. This station was abandoned on account of its being a poor section for gaging, and was reestablished at the highway bridge on the road between Brooklyn and Newburg. The new station is one-half mile above the old one. A bend in the river at the station and the pier of an old bridge just

above interfere with the velocity to some extent. There is a navigation canal and a power canal on the right bank, which carry part of the drainage past the station.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Cuyahoga River at Cleveland, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 30	R. W. Pratt	4.10	428
July 14	do	3.70	123
August 8	E. C. Murphy		212

Mean daily gage height, in feet, of Cuyahoga River at Cleveland, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1		3.75	3.50	6.40	17		3.80	3.35	
2		3.65	3.55	5.40	18		3.80	4.15	
3		3.60	3.45	4.90	19		3.85	6.30	
4		3.60	3.50	5.00	20		3.90	5.40	
5		3.55	3.70	4.60	21		3.65	5.20	
6		3.60	3.80	4.20	22		3.70	5.40	
7		3.60	3.75	4.10	23		3.65	5.30	
8		3.50	3.55	3.90	24		3.70	4.90	
9		3.75	3.50	3.90	25	3.45	3.65	4.70	
10		3.80	3.40	3.60	26	3.55	3.60	4.30	
11		3.75	3.75	3.50	27	3.60	3.60	4.50	
12		3.70	3.50	3.40	28	3.75	3.65	4.30	
13		3.80	3.55		29	3.80	3.60	4.10	
14		4.45	3.50		30	3.55	3.45	4.70	
15		3.85	3.40		31	3.75		4.90	
16		3.80	3.35						

CUYAHOGA RIVER AT INDEPENDENCE, OHIO.

The station on the Cuyahoga River at Cleveland was found unsuited for measurements; accordingly, on September 21, a new bridge at Independence, Ohio, was selected for the purpose of determining the discharge of the stream.

This station is located on a single-span highway bridge at the town of Independence, 10 miles south of Cleveland, Ohio, and 4 miles south of the gaging station formerly located on the highway bridge between Brooklyn and Newburg. The observer is John Yahrans. The initial point is the face of the eastern abutment. The gage is a regulation chain gage bolted to the hand rail of the bridge on the downstream side, 100 feet west of the initial point. The length from the end of the weight

to the back of the ring is 26.84 feet. The conditions at this point are generally favorable, though the current at low water is sluggish, and in the center there is the remains of an old pier used in the support of a former two-span bridge.

The following bench marks have been established: (1) A cross cut on the northeast corner of the top stone of the northerly wing wall of the west abutment; elevation, 23.65 feet above gage datum. (2) A cross cut on the southwest corner of the top stone of the southerly wing wall; elevation, 22.58 feet above gage datum. (3) The top of the inside eyebeam of the lower chord, downstream side, at a point 100 feet west of the initial point; elevation, 23.95 feet above gage datum. Elevation of the center of the pulley is 26.18 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Cuyahoga River at Independence, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 21	R. W. Pratt	4.90	212
October 26	do	4.70	130
November 24	do	5.35	393
December 16	do	5.80	400

Mean daily gage height, in feet, of Cuyahoga River at Independence, Ohio, for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		4.40	4.60	4.90	17		5.70	9.90	5.80
2		4.70	4.40	5.10	18		5.60	7.90	5.80
3		4.60	4.70	5.00	19		5.40	6.70	5.50
4		4.60		5.00	20		5.30	6.00	6.50
5		4.70		4.90	21	4.90	5.10	5.80	7.30
6		4.80		4.80	22	4.90	5.00	5.40	6.80
7		4.90	4.90	5.00	23	4.80	4.90	5.30	6.90
8		11.40	4.70	4.80	24	4.90	4.90	5.10	6.40
9		8.40	4.60	4.80	25	4.90	4.80	4.90	6.90
10		7.30	5.00	5.00	26	4.90	4.70	4.70	6.50
11		7.20	4.80	5.00	27	4.60	4.90	5.30	6.90
12		6.90	4.70	5.20	28	4.70	4.90	5.10	6.80
13		6.70	4.80	5.80	29	4.60	4.70	4.60	6.00
14		6.40	4.80	5.90	30	4.60	4.80	5.50	5.90
15		6.00	4.70	5.60	31		4.90		5.80
16		5.90	4.80	5.80					

OHIO AND ERIE CANAL AT CLEVELAND, OHIO.

The Ohio and Erie Canal parallels Cuyahoga River, and consequently, at the several stations that the United States Geological Survey maintained on the river, the discharge of the canal was found at the same time as the discharge of the river. This was always small, and the result was applied to the measurement of the stream itself. At Akron the readings of the canal are furnished gratuitously by the chief engineer of public works.

At this point the canal discharges over a spillway, the head on which is measured by the gage. The discharge of this canal, besides being of importance in connection with Cuyahoga River, is also used for studying the sewerage disposal of the city of Akron. The discharge is determined by the head acting on a spillway 14.4 feet long. The gage is set with its zero at the same elevation as the crest of the spillway and reads in inches.

BLACK RIVER NEAR ELYRIA, OHIO.

This station was established May 23, 1903, by R. Winthrop Pratt, the object being to furnish data for the water supply of nearby towns. The station is located at the Niel Avenue Bridge, about 5 miles from the center of the city of Elyria, Ohio. The original gage consisted of an inclined 1 by 6 inch board set on edge in the bank and secured to long stakes, and a vertical section nailed to stakes driven in the ground. The inclined section reads from zero to 5 feet and the vertical section from 5 to 12 feet. A regulation chain gage has been installed to replace the rod gage first established. The length from the end of the weight to the marker is 24.67 feet. The gage is read once each day by N. L. Durfee. Discharge measurements are made from the single-span highway bridge. The initial point for soundings is the face of the west abutment. The bed of the stream is a rock ledge, and there is but one channel. The current is sluggish at low stages at the regular section, but may be measured by wading 500 feet below. The channel is straight for 300 feet above and 200 feet below the bridge. The right bank is fairly high, and overflows only in extreme floods. When this occurs a large adjacent cornfield is generally flooded. The left bank is a high rocky bluff, from 75 to 100 feet in height, which can not overflow.

The following bench marks have been established: (1) A wire nail in the root of a double tree which is in line with the center of and 38 feet west from the west end of the bridge. Its elevation is 28.74 feet above gage datum. (2) The top of the flange of the fifth floor beam from the west abutment on the downstream end (almost under the pulley of the gage). Its elevation is 22.56 feet above gage datum.

The elevation of the center of the pulley is 24.67 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Black River near Elyria, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 29	R. W. Pratt	1.00	19
August 22	do	.85	4
September 22	Johnson and Pratt	1.07	27
October 10	R. W. Pratt	2.56	369
November 23	do	1.17	32
December 17	do	1.85	75

Mean daily gage height, in feet, of Black River near Elyria, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.06	1.20	2.40	2.80	1.10	1.20	1.20
2	.....	9.10	1.10	2.10	2.50	.90	1.10	1.30
3	.....	9.10	1.00	1.70	2.20	.90	1.10	1.20
4	.....	9.10	1.00	1.50	2.10	.80	1.10	1.10
5	.....	7.10	1.10	1.40	1.10	1.00	1.30	1.00
6	.....	6.10	1.80	1.20	1.10	1.10	1.10	1.00
7	.....	6.10	1.70	1.20	1.10	1.20	1.10	.90
8	.....	1.90	1.70	1.10	1.40	3.90	1.00	1.30
9	.....	1.80	1.60	1.00	1.30	3.70	1.00	1.20
10	.....	1.80	1.50	1.10	1.30	2.60	1.00	1.20
11	.....	1.60	1.10	1.10	1.30	1.90	1.10	1.40
12	.....	1.50	1.80	1.10	1.20	1.60	1.40	1.50
13	.....	1.60	1.80	1.10	1.10	1.40	1.90	2.10
14	.....	1.80	1.60	1.20	1.10	1.20	1.90	2.20
15	.....	1.80	1.50	1.20	.90	1.20	1.80	2.20
16	.....	1.80	1.50	1.10	.90	1.30	1.90	1.90
17	.....	1.50	1.50	1.10	.90	1.20	2.00	1.80
18	.....	1.50	1.90	1.10	1.80	1.20	2.20	1.10
19	.....	1.40	1.90	1.10	2.16	1.20	1.70	1.60
20	.....	1.80	1.90	1.10	1.90	1.10	1.40	2.10
21	.....	1.80	1.80	1.10	1.80	1.10	1.40	2.30
22	.....	1.60	1.60	1.10	1.50	1.10	1.20	2.80
23	.....	1.50	1.60	1.80	1.10	1.10	1.10	2.60
24	1.10	1.40	1.50	1.80	.90	1.10	1.10	2.70
25	6.10	1.40	1.50	1.80	.90	1.00	1.10	2.70
26	7.10	1.40	1.40	3.10	.80	.90	1.30	2.60
27	1.03	1.50	1.40	6.00	.80	.90	1.40	2.70
28	1.03	1.50	1.40	7.10	.80	.90	1.50	2.20
29	1.07	1.50	1.30	5.70	.90	.90	1.40	2.10
30	1.08	1.20	1.60	3.60	.90	1.20	1.30	2.10
31	1.08	.....	2.80	2.40	.....	1.20	.....	2.10

Rating table for Black River near Elyria, Ohio, from May 24 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.9	9	2.0	182	3.1	555	4.2	940
1.0	18	2.1	212	3.2	590	4.3	975
1.1	29	2.2	244	3.3	625	4.4	1,010
1.2	39	2.3	276	3.4	660	4.5	1,045
1.3	49	2.4	310	3.5	695	4.6	1,080
1.4	59	2.5	345	3.6	730	4.7	1,115
1.5	72	2.6	380	3.7	765	4.8	1,150
1.6	88	2.7	415	3.8	800	4.9	1,185
1.7	107	2.8	450	3.9	835	5.0	1,220
1.8	129	2.9	485	4.0	870	5.1	1,260
1.9	154	3.0	520	4.1	905	5.2	1,300

Tangent at 5 feet gage height, differences above 5 feet 40 per tenth. Table not accurate beyond gage height 2.6 feet.

Estimated monthly discharge of Black River near Elyria, Ohio, for 1903.

[Drainage area 417 square miles.]

Room.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May (24–31)	2,060	24	485	1.16	0.35
June	2,860	24	536	1.29	1.44
July	450	19	94	.23	.26
August	2,060	19	272	.65	.75
September	450	1	82	.20	.22
October	835	1	95	.23	.26
November	244	19	68	.16	.18
December	450	9	174	.42	.48

TIFFIN RIVER NEAR DEFIANCE, OHIO.

This station was established May 19, 1903, by R. Winthrop Pratt. It is located at the highway bridge on the new road to Evansport, one-half mile above the settlement of Brunnesburg, and 3 miles by river above the center of the city of Defiance, Ohio. A standard chain gage is located on the upstream handrail of the bridge about 100 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 28.00 feet. The gage is read once each day by F. A. Goddard. Discharge measurements are made from the single-span highway bridge 140 feet long between abutments. The initial point for soundings is the face of the south abutment. The channel is somewhat curved, but the section is at right angles to the direction of the current. The velocity is sluggish at low stages at the regular section, but can be measured by wading a short distance below the bridge. The bed of the stream is composed of gravel and rock, with deposits of silt at the sides of the channel. Both banks are high; the right bank is not liable to overflow, but the left will overflow at extreme high stages on account of a low place in the road. The bench mark is a cut on the upstream corner of the north abutment. Its elevation is 23.82 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Tiffin River near Defiance, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 19	E. Johnson, jr	4.35	764
August 28	R. W. Pratt	2.80	114
September 11	do	3.05	187
November 12	do	2.75	98
December 9	do	2.52	74

Mean daily gage height, in feet, of Tiffin River near Defiance, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.60	2.90	3.30	7.50	2.60	.....	2.60
2	.....	3.30	2.80	3.10	7.70	2.60	2.50	2.60
3	.....	3.90	2.70	2.90	7.80	2.60	2.50	2.60
4	.....	3.70	2.70	2.90	7.30	.....	2.40	2.60
5	.....	3.70	2.70	4.00	5.50	2.70	3.00	2.60
6	.....	8.50	3.00	3.50	4.30	2.70	4.00	.....
7	.....	8.50	2.90	3.40	3.90	2.90	3.15	2.60
8	.....	9.00	2.80	3.20	3.60	3.20	.....	2.60
9	.....	7.50	2.70	.....	3.40	3.20	3.00	2.60
10	.....	4.70	2.60	2.90	3.10	3.95	2.80	2.60
11	.....	4.60	2.60	2.80	3.10	.....	2.70	2.70
12	.....	3.90	2.60	2.70	2.95	3.70	2.70	2.80
13	.....	3.50	2.60	2.60	.....	3.30	2.80	.....
14	.....	3.30	2.50	2.60	2.90	3.20	2.80	4.40
15	.....	3.10	2.50	2.50	2.90	3.00	.....	4.80
16	.....	2.90	2.40	.....	3.00	2.90	3.00	4.70
17	.....	2.90	2.30	2.40	3.20	2.90	3.10	4.40
18	.....	2.80	2.70	2.40	3.40	2.80	3.10	4.00
19	2.70	2.70	4.00	2.40	3.95	3.00	3.20	3.70
20	2.70	2.60	5.00	2.40	.....	2.90	3.10	.....
21	2.70	2.60	5.30	2.30	4.30	2.90	3.00	3.80
22	2.70	2.60	5.00	2.30	3.60	2.80	.....	4.20
23	2.90	3.00	4.60	.....	3.40	2.70	2.70	4.80
24	3.30	6.50	4.40	2.40	3.20	2.60	2.70	4.80
25	4.20	5.00	4.00	2.40	3.10	2.60	2.70	4.70
26	3.60	4.20	3.80	2.30	2.95	2.50	2.70	4.75
27	3.40	4.00	3.60	2.40	.....	2.50	2.70	.....
28	4.00	3.60	3.10	2.80	2.80	2.50	2.70	4.30
29	3.90	3.20	3.00	4.70	2.80	2.50	.....	3.90
30	4.80	3.00	2.90	.....	2.70	2.50	2.40	3.70
31	3.80	.....	3.40	7.50	.....	2.50	.....	3.60

Rating table for Tiffin River near Defiance, Ohio, from May 19 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.3	56	3.0	167	3.7	440	4.4	785
2.4	63	3.1	200	3.8	487	4.5	835
2.5	70	3.2	235	3.9	535	4.6	885
2.6	77	3.3	272	4.0	585	4.7	935
2.7	91	3.4	311	4.1	635	4.8	985
2.8	111	3.5	352	4.2	685	4.9	1,035
2.9	137	3.6	395	4.3	735	5.0	1,085

Tangent at 4 feet, gage-height. Difference above this point, 50 per tenth. Table not accurate below gage height 0.5 feet nor above gage height 4.4 feet.

Estimated monthly discharge of Tiffin River near Defiance, Ohio, for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
May 19–31	985	91	366
June	3,085	77	740
July	1,235	56	311
August [a]	2,335	56	288
September [b]	2,485	91	607
October [c]	560	70	159
November [d]	585	63	141
December [e]	985	77	464

[a] Discharge for August 9, 16, 23, and 30 estimated.
[b] Discharge for September 13, 20, and 27 estimated.
[c] Discharge for October 4 and 11 estimated.
[d] Discharge for November 1, 8, 15, 22, and 29 estimated.
[e] Discharge for December 6, 13, 20, and 27 estimated.

AUGLAIZE RIVER NEAR DEFIANCE, OHIO.

This station was established May 20, 1903, by R. Winthrop Pratt, and was discontinued August 8, 1903. It was located at the highway bridge called "English Bridge," 3 miles south of Defiance, on the road to Junction, Ohio. The gage was a temporary inclined rod on the bank 200 feet above the east abutment. It was read once each day by D. C. Garman. Discharge measurements were made from the two-span highway bridge. The bench mark was a cut on the upstream side of the east abutment at an elevation of 10 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following measurement was made by E. Johnson, jr., in 1903:

March 18: Distance from top of lower chord to water surface, at a point 2 feet east of first pier, 21.90 feet; discharge, 2,721 second-feet.

Mean daily gage height, in feet, of Auglaize River near Defiance, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	8.00	6.70	6.50	.....	0.70	17	.....	7.60	6.40	.....	.....	.....
2	.....	7.90	6.70	7.20	.....	.....	18	.....	7.70	6.70	.....	.....	.....
3	.....	7.80	6.70	7.40	.....	.70	19	.....	7.60	6.70	.....	.....	.50
4	.....	7.50	6.70	7.00	.....	.....	20	6.70	7.50	6.70	.....	2.10	.45
5	.....	7.80	6.70	6.80	.....	.....	21	6.60	7.10	6.60	.....	1.50	.45
6	.....	9.70	6.60	6.70	.....	.....	22	6.80	7.00	6.70	.....	1.30	.45
7	.....	11.70	6.60	6.60	.....	.....	23	6.80	7.00	6.80	.....	1.20	.....
8	.....	12.10	6.50	6.50	.....	.....	24	6.90	7.00	6.80	.....	1.00	.40
9	.....	12.00	6.40	.....	.....	.....	25	7.20	7.20	6.70	.....	1.00	.....
10	.....	11.10	6.40	.....	.....	.....	26	7.80	7.20	6.70	.....	1.00	.....
11	.....	9.90	6.40	.....	.....	.....	27	8.30	7.20	6.70	.....	1.00	.....
12	.....	9.10	6.30	.....	.....	.....	28	8.90	7.10	6.70	.....	.80	.....
13	.....	8.40	6.30	.....	.....	.....	29	9.10	7.00	6.70	.....	.80	.....
14	.....	8.00	6.30	.....	.....	.....	30	8.90	6.80	6.60	.....	.80	.....
15	.....	7.80	6.30	.....	.....	.60	31	8.40	.....	6.50	.....	.....	.....
16	.....	7.50	6.30	.....	.....	.....							

BLANCHARD RIVER AT OTTAWA, OHIO.

This station was established November 22, 1902, by Benjamin H. Flynn. It is located at the Cincinnati, Hamilton and Dayton Railroad bridge in the town of Ottawa, Ohio. The upper portion of the gage is inclined and graduated, so as to read directly to feet and tenths. The lower portion of the gage is vertical and graduated to feet and tenths; it is spiked to a stake driven into the ground. The initial point for soundings is on the right bank of the river. The channel is straight for 200 feet above and 500 feet below the bridge. The right bank is high and does not overflow. The left bank is low, but seldom overflows, as the water is confined by the railroad. The bed of the stream is firm gravel, with mud along the banks; the current is sluggish. The bench mark is the upper of two parallel marks cut in the east end of the south main pier of the bridge; elevation, 14 feet above the zero of the gage. The observer is C. W. Ewing, who reads the gage twice daily. The station was discontinued July 25, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Blanchard River at Ottawa, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 17	E. Johnson, jr	4.20	617
June 20	R. W. Pratt	.50	49

Mean daily gage height, in feet, of Blanchard River at Ottawa, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	2.50	12.58	20.30	0.67	0.45	1.25	0.48	.....
2	2.50	8.60	19.92	.65	.40	.95	.38	1.80
3	2.62	7.90	16.65	4.80	.50	.80	.30	1.70
4	5.85	13.45	12.25	16.60	1.12	.80	.30	(a)
5	8.80	16.55	9.80	18.15	1.35	.75	.30	.....
6	9.12	15.85	11.45	16.45	1.28	.68	.28	.....
7	7.85	13.60	11.05	12.20	1.18	3.15	.25	.....
8	6.00	8.05	9.00	7.10	1.02	6.15	.25	.....
9	4.25	5.95	10.40	4.20	.92	6.55	.25	.....
10	3.10	5.60	11.40	3.25	.90	4.95	.17	.....
11	1.00	7.30	12.35	2.95	.85	2.95	.15	1.60
12	.90	11.20	11.85	9.60	.80	2.10	.15	1.50
13	.90	12.00	9.20	13.65	.80	1.35	.15	1.50
14	.90	10.15	5.75	14.70	.75	.98	.10	2.20
15	.90	7.80	5.25	15.30	.68	.88	.05	1.90
16	.80	4.90	4.70	14.20	.60	.82	.05	.....
17	.78	4.00	4.20	10.50	.52	.72	.05	.....
18	.70	3.02	4.15	7.20	.50	.65	.05	.....
19	.70	2.20	4.00	5.30	.48	.52	.32	.....
20	.55	1.90	3.80	3.00	.40	.50	.40	.....
21	.38	1.90	4.10	2.20	.40	.42	.60	.....
22	.32	1.90	3.70	1.30	.40	.35	.88	.....
23	.30	1.90	3.25	.75	.50	.30	1.10	.....
24	.30	1.90	3.20	.25	.50	1.00	1.25	.....
25	.30	2.10	3.15	.20	.60	1.82	.95	.....
26	.30	2.50	2.50	.50	1.20	1.45	1.80	.....
27	.50	4.50	1.93	.80	1.20	1.18	1.80	.....
28	5.70	16.00	1.50	.80	2.15	.80	1.80	.....
29	13.12	.....	1.22	.60	2.95	.62	1.80	.....
30	15.35	.....	1.05	.60	2.50	.52	1.80	.....
31	15.35	.....	.85	.....	1.75	.....	1.80	.....

a Gage broken.

OTTAWA RIVER AT LIMA, OHIO.

This station was established November 21, 1902, by B. H. Flynn. It is located at the Rausch bridge, about 2½ miles east of the center of the city of Lima, Ohio, a few hundred feet north of the Pittsburg and Fort Wayne Division of the Pennsylvania Railroad. The gage is a 2 by 8 inch plank spiked to the face of the south abutment on the downstream side. This station was discontinued July 27, 1903. Up to this time the gage was read once each day by Edward King, the engineer at the pump station. Discharge measurements are made from the bridge to which the gage is attached. This is a single-span bridge 75 feet long between abutments. The initial point for soundings is the end of the guard rail on the downstream side at the left bank. The channel is straight for about 250 feet above and 500 feet below the station. The banks are of medium height, but the abutments of the bridge will confine the water to the channel beneath the

bridge at all stages. The bed of the stream is rocky, with a small deposit of mud at the bridge. At low water there is not sufficient velocity at the bridge to be measured, but gagings can be made by wading about 300 feet above the bridge. The bench mark is a cut in the downstream face of the south abutment near the gage. Its elevation is 8 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Ottawa River at Lima, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 16	E. Johnson, jr	2.82	107
June 20	R. M. Pratt	2.25	7

Mean daily gage height, in feet, of Ottawa River at Lima, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.70	3.80	5.80	2.60	2.70	2.20	2.10
2	2.65	3.55	4.70	2.55	2.70	2.20	2.10
3	3.20	3.50	4.30	4.20	2.60	2.15	2.10
4	4.30	6.20	5.00	7.60	2.50	2.10	2.05
5	3.80	5.70	4.60	5.50	2.40	3.58	2.05
6	3.60	4.30	4.20	4.45	2.35	4.50	2.00
7	3.30	3.70	3.80	3.60	2.30	4.30	2.00
8	3.20	3.55	3.80	3.40	2.30	4.60	2.00
9	3.10	3.50	4.10	3.30	2.25	3.40	2.00
10	3.00	3.60	3.80	3.20	2.25	2.95	2.00
11	3.10	3.90	3.80	3.40	2.20	2.70	2.00
12	3.00	4.50	3.75	3.80	2.20	2.55	2.00
13	3.00	4.45	3.60	4.50	2.20	2.45	2.00
14	2.90	4.40	3.40	5.50	2.15	2.35	2.00
15	2.80	4.30	3.20	4.50	2.15	2.30	2.00
16	2.75	4.20	2.85	4.10	2.10	2.30	2.00
17	2.75	4.00	2.90	3.60	2.10	2.30	2.00
18	2.70	3.80	3.00	3.20	2.10	2.25	2.00
19	2.70	3.60	2.90	3.00	2.10	2.20	2.00
20	2.65	3.40	2.80	2.80	2.10	2.25	2.00
21	2.65	3.20	2.90	2.70	2.10	2.25	2.00
22	2.70	3.00	2.80	2.65	2.10	2.25	2.00
23	2.70	2.70	2.75	2.60	2.10	2.45	2.00
24	2.75	2.65	2.70	2.55	2.10	2.40	2.00
25	2.80	3.00	2.75	2.70	2.20	2.30	2.00
26	2.95	4.00	2.80	3.30	2.15	2.25	2.00
27	3.60	5.50	2.75	3.00	2.15	2.20	2.00
28	4.80	7.40	2.70	2.80	2.30	2.15	.....
29	5.60	.....	2.65	2.75	2.30	2.10	.....
30	4.90	.....	2.60	2.70	2.30	2.10	.....
31	4.00	.....	2.60	.....	2.25	.....	.....

MAUMEE RIVER NEAR SHERWOOD, OHIO.

This station was established May 19, 1903, by R. Winthrop Pratt. It is located at the highway bridge 2½ miles south of Sherwood, Ohio, and 200 feet upstream from the Cincinnati and Northern Railroad bridge. The inclined gage which was established on the bank under the north end of the bridge was destroyed. A regulation chain gage was installed in June. This is bolted to the hand rail of the bridge on the upstream side, 200 feet from the south abutment. The length of the chain from the end of the weight to the marker is 28.88 feet. The channel is straight for 1,000 feet above and 500 feet below the bridge. Both banks are high and clean, and both may overflow at extreme high water. A high-water gage is painted on the bridge abutment at the north end of the bridge. The observer is George J. Coffin. Discharge measurements are made from the two-span highway bridge, which has a total length of 300 feet between abutments. The initial point for soundings is the face of the north abutment.

The following bench marks have been established: (1) A copper bolt in the stepping stone of the west wing wall of the north abutment (stone is in tier just below the top tier). It is 22.30 feet above the zero of the gage. (2) A cut in the iron hand rail directly over the pulley of the gage. Its elevation is 29.69 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Maumee River near Sherwood, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 29	R. W. Pratt	2.50	305
September 11	do	2.60	435
November 12	do	2.10	211
December 9	do	2.23	292

Mean daily gage height, in feet, of Maumee River near Sherwood, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	2.60	.....	4.30	2.40	2.10	2.20
2	.....	.....	2.50	.....	4.50	2.30	2.10	2.20
3	.....	.....	2.40	.....	4.50	2.20	2.10	2.20
4	.....	.....	2.30	.....	4.50	2.30	2.10	2.20
5	.....	.....	2.20	2.20	4.30	2.30	2.10	2.20
6	.....	.....	2.90	2.20	3.80	2.30	2.20	2.20
7	.....	.....	2.80	2.40	3.40	2.30	2.20	2.20
8	.....	.....	2.70	2.50	3.00	2.30	2.20	2.20
9	.....	.....	2.60	2.40	2.80	2.30	2.20	2.20
10	.....	.....	2.50	2.40	2.70	2.30	2.20	2.20
11	.....	4.20	2.30	2.30	2.50	2.30	2.20	2.20
12	.....	3.60	2.20	2.20	2.40	2.30	2.20	2.20
13	.....	3.20	2.20	2.20	2.40	2.40	2.20	2.20
14	.....	2.90	2.20	2.20	2.40	2.60	2.20	2.30
15	.....	2.80	2.10	2.20	2.40	2.60	2.20	2.60
16	.....	2.70	2.00	2.20	2.35	2.50	2.20	2.90
17	.....	2.60	1.90	2.10	2.40	2.50	2.20	3.20
18	.....	2.60	2.30	2.10	2.45	2.40	2.30	3.20
19	.....	2.40	2.30	2.20	2.55	2.40	2.50	3.20
20	2.30	2.20	2.20	2.20	2.70	2.30	2.50	3.20
21	2.20	2.20	.....	2.20	2.90	2.30	2.50	3.40
22	2.20	2.30	.....	2.20	3.10	2.30	2.50	3.40
23	2.30	2.40	.....	2.20	3.10	2.30	2.50	3.40
24	2.40	2.70	.....	2.20	2.80	2.20	2.40	3.40
25	2.80	3.00	.....	2.10	2.70	2.20	2.40	3.40
26	3.80	3.70	.....	2.10	2.60	2.20	2.30	3.50
27	3.80	3.40	.....	2.10	2.50	2.20	2.30	3.70
28	3.70	3.00	.....	2.30	2.60	2.20	2.30	3.70
29	3.80	2.80	.....	2.50	2.30	2.20	2.20	3.70
30	3.80	2.70	.....	2.50	2.30	2.20	2.20	3.60
31	3.80	.....	.....	2.50	.....	2.10	.....	3.50

LAKE HURON DRAINAGE BASIN.

South of Saginaw Bay the Lake Huron slope is very narrow and is drained by brooks and runnels a few miles in length. The so-called Thumb of the Mitten is drained by three streams which flow northwest, known as the Willow, Pinnepog, and Pigeon, lying in a flat, marshy region.

The drainage surrounding Saginaw Bay is included in the Saginaw River system.

Northward from Saginaw Bay are Rifle, Au Sable, and Thunder Bay rivers, streams having considerable fall, excellent ground storage in sand areas, and well-sustained flow. The rainfall is less than on the western or Lake Michigan slope of the State.

Cheboygan River also belongs in the Lake Huron drainage.

The following is a list of the stations maintained during 1903 in the Lake Huron drainage:

Tittabawassee River at Freeland, Mich.
Rifle River at Omer, Mich.
Au Sable River at Bamfield, Mich.
Thunder Bay River near Alpena, Mich.

TITTABAWASSEE RIVER AT FREELAND, MICH.

Tittabawassee River forms the most northerly of the three tributaries which join to form Saginaw River at Saginaw. Their combined catchment areas receive the drainage from a crescent-shaped region of about 6,000 square miles surrounding Saginaw Bay. Tittabawassee River drains an area relatively flat, with clay soil predominating, and with occasional sand patches; the glacial sands and clay overlying the rock of the Coal Measures to a depth of several hundred feet. The area is largely cleared and under cultivation. From railroad profiles, the fall of the stream from Highwood to its mouth, a distance of about 50 miles along the river, is estimated at 140 feet.

The gaging station was established August 22, 1903, by W. M. Gregory. It is located at Freeland Highway Bridge, 10 miles northwest of Saginaw, in sec. 21, T. 13 N., R. 3 E., one-half mile from Freeland, Mich. The bridge consists of two main spans 320 feet between abutments, an auxiliary trestle span of 150 feet, and two overflow channels under the highway, some distance from the right end of the bridge. The gage is a standard chain gage, bolted to the upstream side of the iron guard rail, 180 feet from the left end. The length of the chain from the end of the weight to the marker is 31.33 feet. The gage is read twice each day by W. E. Dennison. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The downstream hand rail is painted and numbered at 5-foot intervals. The initial point for soundings is the left end of

the hand rail, on the downstream side of the bridge. The channel is straight above and below the station. The current is uniform, and has a medium velocity. It may be affected at times by strong winds, which have a free sweep through the valley. The right bank has a flood plain which is inundated only at extreme flood stages. The left bank is high and smooth, and is not subject to overflow. The bed of the stream is composed of clay and cobblestones, and is fairly permanent, but tends to cut near the left bank. Bench mark No. 1 is the top of a nail head 1 foot below the top of the cedar corner post of the road fence in front of the blacksmith shop on the left bank. Its elevation is 32.96 feet above gage datum. Bench mark No. 2 is a circle inclosing the letters "B. M." painted on the top of the downstream end of the left pier. Its elevation is 22.88 feet above gage datum. The elevation of the top of the gage pulley is 31.33 feet, and that of the reference point, the top of the hand rail over the pulley, is 31.50 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer

Discharge measurements of Tittabawassee River at Freeland, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 2	W. M. Gregory	[a] 2.89	1,430
July 28	Horton and Gregory	[a] 1.28	534
August 22	W. M. Gregory	1.52	537
September 23	do	2.70	1,375

[a] Gage not erected, stage approximate.

Mean daily gage height, in feet, of Tittabawassee River at Freeland, Mich., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.82	2.85	2.28	2.45	17		4.92	2.98	2.85	2.52
2		2.52	5.90	2.58	2.58	18		5.20	3.30	2.65	2.58
3		2.35	7.15	2.50	2.60	19		4.95	3.82	3.00	2.65
4		2.08	7.15	2.25	2.60	20		4.30	3.72	3.35	2.70
5		1.80	6.10	2.50	2.60	21		3.52	3.42	3.82	2.70
6		1.75	4.95	2.30	2.55	22	1.48	3.18	3.10	4.22	2.75
7		1.72	4.35	2.22	2.60	23	1.56	2.72	2.88	3.85	2.80
8		1.85	4.60	2.00	2.65	24	1.68	2.48	2.70	3.20	2.82
9		2.22	4.90	2.10	2.60	25	1.58	2.28	2.65	2.75	2.90
10		2.45	4.60	2.28	2.52	26	1.62	2.20	2.45	2.55	3.00
11		2.75	4.00	2.12	2.42	27	1.66	2.25	2.38	2.48	3.00
12		3.30	3.60	2.28	2.38	28	1.75	2.32	2.30	2.40	3.00
13		2.98	3.28	2.70	2.30	29	2.01	2.40	2.28	2.42	2.90
14		2.92	3.15	2.65	2.35	30	2.52	2.58	2.30	2.40	2.80
15		3.12	3.00	2.58	2.40	31	2.54		2.30		2.72
16		3.72	2.92	2.42	2.42						

RIFLE RIVER AT OMER, MICH.

Rifle River rises in the vicinity of Rose City, northern Ogemaw County, flows southward to the northwest corner of T. 19 N., R. 4 W., turns easterly, and then gradually to the southeast, and finally enters Saginaw Bay. The basin is heavily overlain with glacial deposits, sand, overwash gravel, and till. There are two old lumber dams in the basin and a water-power dam at Omer. There are numerous small glacial lakes, but no controlled storage, and a very small percentage of natural water surface in the drainage basin. The basin is narrow and elongated, having a width of about 3 miles at the mouth. Ramifying tributaries in the headwaters give the stream a relatively large volume at the entrance of West Branch, in T. 21 N., R. 3 E. At Omer the stream falls from an elevation of 608 to 595 feet over a dam, affording power for a grist and saw mill. The drainage area at Omer is 364 square miles, and at the mouth of the stream is 385 square miles.

The gaging station was established September 1, 1902. It is located at the Detroit and Mackinaw Railroad bridge, one-half mile below the dam in Omer village. The gage is a wire gage with a boxed scale, graduated to feet and tenths, and is attached to the downstream guard rail of the bridge. It is read twice each day by M. D. Murchison. The bridge has a single span of 109 feet. The bed is of sand and fine drift. The channel is curved and does not pass beneath the bridge at right angles. The bed is stony on the concave and sandy on the convex side, with some piles and sunken logs in between. The bench mark is on the right corner of the left bridge abutment on the downstream side. Its elevation is 15.75 feet above gage datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Rifle River at Omer, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 11	E. P. Roundey	10.29	[a] 1,606
May 21	W. M. Gregory	5.37	268
August 1	E. C. Murphy	5.06	238
Do	W. M. Gregory	4.96	240
September 22	do	5.52	357

[a] Slight ice obstruction.

Mean daily gage height, in feet, of Rifle River at Omer, Mich., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.64	7.60	7.42	6.05	5.64	4.89	4.68	4.49	5.50	5.05	4.86	5.41
2	6.61	7.37	7.39	6.43	5.62	4.99	5.05	4.39	5.10	4.95	4.84	5.76
3	6.38	7.27	7.44	8.41	5.62	5.09	4.85	4.81	5.00	5.22	5.18	5.41
4	6.01	7.47	7.46	7.53	6.97	4.71	4.85	5.87	5.36	5.47	5.28	5.46
5	6.24	7.30	7.24	7.63	6.17	4.86	4.88	5.14	5.20	5.27	5.14	5.21
6	6.18	7.25	7.46	6.51	5.82	4.81	5.08	4.94	4.70	5.22	5.08	5.14
7	6.64	7.33	8.04	6.38	5.17	4.73	5.10	5.01	4.88	5.25	5.16	5.41
8	6.21	7.25	10.22	6.11	5.42	4.61	4.72	4.64	5.28	5.69	4.81	5.36
9	6.28	6.93	10.72	6.28	5.14	4.76	4.98	4.79	6.23	5.77	5.18	5.36
10	6.01	6.95	11.59	6.08	5.50	5.19	4.58	4.99	6.10	5.65	5.08	5.46
11	6.21	6.93	10.82	6.23	5.32	4.71	4.42	4.77	6.76	5.15	5.01	5.51
12	6.41	7.27	10.14	6.51	5.30	4.73	4.72	4.69	6.06	5.32	5.84	5.61
13	6.34	7.47	10.14	6.95	5.30	4.86	4.60	4.49	5.63	5.45	5.54	5.74
14	6.36	7.33	9.29	7.68	5.42	4.96	5.05	4.51	5.43	5.52	5.36	6.36
15	6.57	7.29	9.15	9.14	5.66	4.70	4.69	4.33	5.65	5.28	5.16	6.21
16	6.33	7.02	8.58	9.54	5.46	5.15	4.69	4.50	6.07	5.41	5.18	6.51
17	6.37	6.89	7.88	8.57	5.21	5.00	4.67	4.78	6.29	5.46	5.41	6.34
18	6.25	6.54	7.61	7.67	5.69	5.28	4.64	4.46	6.52	5.34	5.24	6.24
19	6.33	6.44	7.85	7.12	5.16	5.05	4.71	4.30	6.29	5.34	5.41	6.04
20	6.10	6.49	8.38	6.92	5.06	5.15	4.69	4.30	5.42	5.48	5.31	5.61
21	6.45	5.96	8.45	6.67	5.11	4.85	4.54	4.58	5.57	5.46	5.31	6.21
22	6.53	6.49	8.03	6.34	4.99	5.42	4.87	4.40	5.39	5.44	5.28	6.08
23	6.53	6.49	7.51	6.02	5.23	5.10	4.99	4.33	5.37	5.36	5.21	6.06
24	6.20	6.52	7.51	6.72	5.26	5.72	4.81	4.83	5.32	5.24	5.48	5.91
25	5.93	6.22	7.41	5.82	5.36	6.08	4.81	4.73	5.02	4.94	5.41	5.86
26	6.55	6.56	7.08	5.90	5.36	5.22	4.91	4.40	5.37	5.28	6.06	5.88
27	6.17	6.29	7.01	5.82	5.36	4.85	4.81	4.50	5.39	5.26	5.41	5.76
28	6.35	6.84	6.75	5.67	5.61	4.90	4.69	4.73	5.27	5.31	5.31	5.98
29	6.67	.....	6.41	5.57	5.06	4.95	4.51	4.58	4.77	5.18	5.08	5.78
30	8.00	.....	6.31	5.72	5.61	5.22	4.57	4.98	4.95	5.06	5.16	6.15
31	8.15	.....	5.73	.....	5.33	.....	4.34	5.88	.....	5.11	.....	5.94

[a] Reduced to original gage datum.

AU SABLE RIVER AT BAMFIELD, MICH.

Au Sable River rises in southern Otsego County, flows south to Grayling, thence east to the west line of Alcona County, from which point it follows a tortuous course in a general southeasterly direction to its outlet in Lake Huron at Oscoda. Its drainage basin embraces a region at one time noted for the abundance of white pine. The area is now almost entirely cleared of its valuable native timber and contains a large extent of sandy plains covered with shrub conifers. There are also areas of diversified soils, pink clay, loam, and gravel. The basin is underlain by Coldwater shales. Rock outcrops are very rare, the stream bed being usually clay or sand.

The basin contains numerous small lakes, wet sand areas, and undrained hollows, the topographic features being mainly the work of the retreating ice of the Glacial epoch.

At Bamfield, about 40 miles from the outlet, following the river, the elevation is about 850 feet above sea level. From this point to the

mouth of the stream numerous excellent sites for water-power development occur. These water powers are favored by a stream bed of firm clay, the river being flanked in many places with high terraced clay bluffs, rising often 60 to 100 feet above the stream. In some places the upper half or two-thirds of the bluff is sand, the lower portion being clay. At the clay horizon numerous springs appear. The tributaries are not important, nearly all the rainfall being directly absorbed by the porous sand areas. The drainage area above the junction of the two branches of Au Sable River is 1,005 square miles; above the gaging station at Bamfield, 1,425 square miles; and above its mouth at Oscoda, 1,932 square miles.

A gaging station was established at the highway bridge at Bamfield August 27, 1902, and gage readings have been taken twice each day since that date. The observer is William H. Bamfield. The gage is a vertical scale graduated to feet and tenths, attached to the left side of the left pier supporting the main bridge span on the downstream side. The bridge has three spans, one a main Pratt truss span of 92 feet, with flood channels at ends. One truss is supported on trestle work that is clogged with drift. Only a small part of the flow, however, passes through this channel at high water. The channel is straight for 800 feet below the station, and in this distance slight rifts occur. It is straight for 500 feet above the gage. The channel has a width at ordinary stage of 140 feet. The bed of the stream is composed of sand and gravel, and is somewhat rough, with sunken logs and short piles, but is permanent. The velocity is moderate to rapid. The banks are low and are skirted on the right by a flood plain, which is, however, seldom overflowed. Beyond the flood plain on the right, and close to the river on the left, are high gravel banks. The stream freezes over in winter so that the relation of gage height to discharge differs from that in summer. Wire spikes, driven into the upstream end of the left pier, serve as a temporary bench mark. Its elevation is 8.00 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Au Sable River at Bamfield, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	Horton and Roundey	1.10	1,145
March 13	E. P. Roundey	2.60	1,999
May 19	W. M. Gregory	1.48	1,445
July 31	Gregory and Murphy	.94	1,109
September 4	W. M. Gregory	1.20	1,187

Mean daily gage height, in feet, of Au Sable River at Bamfield, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.10	1.40	3.00	2.20	1.75	1.10	1.10	.90	1.95	1.20	1.05	1.00
2	1.10	1.40	3.05	2.25	1.70	1.05	1.10	.90	1.85	1.20	1.00	1.10
3	1.05	1.40	1.95	2.65	1.85	1.00	1.10	.95	1.50	1.20	1.00	1.10
4	1.00	1.35	1.10	2.70	1.90	1.00	1.20	1.60	1.25	1.45	1.00	1.10
5	1.00	1.30	1.10	2.65	1.75	1.00	1.25	2.60	1.20	1.40	1.00	1.10
6	1.00	1.30	1.00	2.60	1.70	1.00	1.15	2.60	1.10	1.25	1.00	1.10
7	1.00	1.30	1.70	2.40	1.60	1.00	1.05	2.50	1.10	1.30	1.00	1.10
8	1.00	1.35	1.90	2.30	1.60	.95	1.00	2.50	1.10	1.40	1.00	1.10
9	1.00	1.40	2.00	2.20	1.95	.95	.90	2.60	1.35	1.40	1.00	1.20
10	1.30	1.40	2.40	2.10	1.90	1.00	.90	2.50	1.75	1.40	1.00	1.20
11	1.30	1.40	2.60	2.10	1.75	1.00	.90	2.60	2.00	1.40	1.00	1.20
12	1.30	1.40	2.60	2.10	1.70	1.00	.90	2.60	2.00	1.40	1.00	1.40
13	3.60	1.45	2.60	2.20	1.60	1.00	.90	2.65	2.00	1.35	1.00	1.40
14	3.70	1.50	3.00	2.30	1.50	1.05	.95	2.30	2.00	1.30	1.00	1.40
15	3.75	1.50	3.05	2.50	1.50	1.00	1.00	2.10	1.90	1.30	1.10	2.00
16	3.80	1.50	3.00	2.65	1.40	1.00	1.00	1.90	2.00	1.35	1.10	2.00
17	3.80	1.50	3.00	2.85	1.35	1.00	1.00	1.60	2.00	1.40	1.10	3.00
18	3.80	2.00	3.10	3.00	1.30	1.00	1.00	1.40	1.90	1.40	1.10	3.00
19	3.80	3.00	3.10	3.00	1.35	1.00	1.00	1.25	1.90	1.35	1.05	3.00
20	3.80	3.00	3.20	3.10	1.50	1.00	1.00	1.10	1.90	1.30	1.00	3.00
21	3.70	3.00	3.25	2.90	1.50	1.05	1.25	1.10	1.90	1.30	1.00	3.00
22	3.65	3.10	3.10	2.70	1.35	1.20	1.40	1.00	1.90	1.20	1.00	3.00
23	3.70	3.10	3.00	2.50	1.30	1.20	1.30	1.00	1.90	1.20	1.00	2.65
24	3.80	3.00	3.00	2.50	1.30	1.10	1.20	.90	1.90	1.10	1.00	2.30
25	3.80	3.00	3.00	2.40	1.30	1.10	1.15	.80	1.65	1.10	1.00	2.20
26	3.80	3.00	2.80	2.35	1.40	1.10	1.05	.80	1.35	1.10	1.00	2.00
27	3.60	3.00	2.65	2.25	1.40	1.00	1.00	.80	1.30	1.10	1.00	2.00
28	3.60	3.00	2.60	2.10	1.55	1.10	1.05	.90	1.30	1.10	1.00	2.00
29	3.50	.....	2.50	2.00	1.55	1.15	1.00	1.00	1.30	1.10	1.00	2.00
30	1.40	.....	2.50	1.90	1.40	1.10	.95	1.55	1.30	1.10	1.00	2.00
31	1.50	.....	2.40	.....	.....	.....	.90	1.95	.....	1.10	.....	2.60

THUNDER BAY RIVER NEAR ALPENA, MICH.

Thunder Bay River is tributary to Lake Huron at Alpena, Mich. The drainage basin is largely underlain by fissured limestone, more or less overlain with sand, and covered with dwarfed timber. The original pine forest has been largely lumbered. The drainage basin contains numerous small lakes in the region of the headwaters; it also contains Hubbard Lake, having a water surface of 13.4 square miles. The regimen of the stream is comparatively steady, but is more or less influenced by the operation of lumbermen's dams.

A gaging station was established at the dam of the Fletcher Paper Company, 4 miles above Alpena, April 4, 1901. The run off for years preceding 1903 will be found in Water Supply Paper No. 83, pages 289–293. The record includes two readings each day of the depth on the crest gage, located 75 feet upstream from the headgates, opposite the left end of the dam. The dam is of timber, practically watertight, and is usually surmounted by flashboards. It contains, in addition to three spillways, sections of lengths 90, 105, and 181.5, and a log slide

40 feet in width. The crest of the dam was originally level, but settlement of the middle section has made it necessary to subdivide the spillways into several short sections, each assumed level at its average elevation, for purposes of calculation. The discharge over the main dam has been computed by the weir formula, using coefficients derived from Cornell University experiment No. 13 of the United States Deep Waterways Board, for a dam of similar cross section. Discharge over flashboard sections has been calculated by means of the Francis formula. There is also a subsidiary log way and a headrace overflow, the latter 3 feet in width, the flow through which has been computed by suitable formulas. The adjoining pulp and paper mill has 14 pairs of 26-inch Trump model turbines, arranged in three groups, each containing four turbines on horizontal shafts, with one double horizontal turbine. The daily run of the turbines and the working head on the wheels, which is determined from readings of the crest and tailrace gage, is also recorded.

The observations of this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Thunder Bay River near Alpena, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	716	511	347	1,728	823	585	619	1,045	2,117	693	497	550
2	867	958	678	1,535	665	475	602	464	2,154	770	497	502
3	867	793	680	1,614	638	496	490	647	2,053	1,454	465	454
4	867	627	719	1,273	1,185	494	377	1,330	1,296	1,524	465	330
5	867	705	715	1,529	1,436	489	411	1,969	1,051	1,267	465	491
6	867	705	722	1,601	1,136	464	557	1,464	1,047	752	465	25
7	867	548	759	1,438	1,397	162	618	1,906	600	1,372	465	750
8	947	343	801	1,273	1,344	541	843	2,343	774	1,182	433	604
9	442	540	1,173	1,279	1,732	512	645	2,290	659	1,063	745	290
10	451	534	1,988	1,175	1,094	398	695	2,039	1,059	956	530	545
11	356	370	2,041	1,330	1,017	353	661	2,111	889	1,249	576	538
12	470	689	2,120	2,186	715	427	565	1,706	936	815	652	517
13	470	391	2,265	1,505	996	437	548	981	1,587	852	702	189
14	466	867	2,678	1,809	1,041	621	569	1,118	722	806	739	434
15	451	629	3,304	1,555	645	505	565	1,024	792	741	415	468
16	470	1,014	2,901	1,877	1,038	708	496	995	1,137	876	727	462
17	451	624	2,901	1,584	94	657	437	567	873	824	761	524
18	264	557	3,064	1,756	624	645	356	737	1,110	532	621	545
19	470	858	2,477	2,023	656	661	181	747	926	854	495	542
20	470	999	3,791	1,816	632	656	524	672	1,333	993	529	491
21	227	999	4,440	1,485	523	568	468	605	704	891	515	604
22	343	999	4,864	1,325	652	441	569	594	791	734	359	588
23	442	999	3,072	1,752	650	655	612	322	793	674	636	545
24	451	841	3,072	1,325	212	650	649	544	832	770	636	516
25	343	659	2,901	1,272	565	724	642	686	815	866	636	332
26	470	534	2,539	1,046	628	709	948	592	865	419	525	597
27	470	793	2,434	1,338	517	668	530	592	280	622	482	308
28	470	499	1,935	1,274	505	700	617	590	609	551	463	579
29	615	.....	2,302	952	*689	517	659	878	780	600	338	536
30	543	.....	718	828	596	626	1,346	169	377	596	544	514
31	1,042	.....	1,226	.....	228	.....	1,283	1,056	.....	622	.....	524

Estimated monthly discharge of Thunder Bay River near Alpena, Mich., for 1903.

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
January	1,042	227	565	0.44	0.51	1.31
February	1,014	343	699	.55	.57	2.05
March	4,864	347	2,117	1.67	1.93	1.76
April	2,186	828	1,482	1.16	1.29	2.05
May	1,732	94	792	.62	.71	2.71
June	709	162	551	.44	.49	2.94
July	1,346	181	616	.48	.55	4.96
August	2,343	169	1,058	.83	.95	5.75
September	2,154	280	1,002	.79	.88	3.51
October	1,524	419	868	.68	.78	1.91
November	761	338	546	.43	.48	1.36
December	750	25	480	.38	.44	1.48
The year	4,864	25	903	.71	9.58	31.79

LAKE MICHIGAN DRAINAGE BASIN.

The Lake Michigan drainage basin comprises a comparatively narrow strip of flat or gently rolling land in eastern Wisconsin, on the west shore of the lake, and a much wider strip of nearly the same character in Michigan on the east shore of the lake. The principal streams entering the lake from the west are the Fox and Menominee rivers; from the east, the St. Joseph, Kalamazoo, Grand, Muskegon, and Manistee rivers.

The following is a list of the stations maintained during 1903 in the Lake Michigan drainage:

Boardman River at Traverse City, Mich.
Manistee River at Sherman, Mich.
Muskegon River at Newaygo, Mich.
Grand River at Grand Rapids, Mich.
Crockery Creek at Slocums Grove, Mich.
Grand River at North Lansing, Mich.
Red Cedar River at Agricultural College, Mich.
Kalamazoo River near Allegan, Mich.
St. Joseph River at Buchanan, Mich.
Fawn River near White Pigeon, Mich.
St. Joseph River at Mendon, Mich.
Fox River at Omro, Wis.
Fox River at Wrightstown, Wis.
Wolf River at Winneconne, Wis.
Fond du Lac River (East Branch) at Fond du Lac, Wis.

Fond du Lac River (West Branch) at Fond du Lac, Wis.
Menominee River near Iron Mountain, Mich.
Iron River near Iron River, Mich.
Escanaba River near Escanaba, Mich.

BOARDMAN RIVER AT TRAVERSE CITY, MICH.

A gage was erected at Upper Union Street Bridge on Boardman River, July 14, 1903, and the stream stage was observed twice daily by D. McLachlan. The record is furnished by Traverse City.

Boardman River drains a generally level sand-covered area tributary to Lake Michigan through Grand Traverse Bay. The upper drainage basin is 10 miles in breadth; tributaries are few, and there are a small number of undrained lakes and ponds. Near the mouth the drainage area becomes much narrower and the fall is rapid, water power being utilized to some extent.

Boardman Lake lies above Traverse City, at an elevation of about 25 feet above Lake Michigan. The outlet of the lake makes an abrupt bend and flows parallel with the water front of Traverse Bay for one-half mile above its outlet. A dam furnishes power for a flour mill, drawing its water supply from Boardman Lake.

In order to avoid as far as possible backwater from Traverse Bay the gage was placed near the foot of the dam. The discharge measurements have been made by current meter at the Park Place Bridge, near the mouth of the river.

A current-meter measurement of Boardman River at Kalkaska, made by W. M. Gregory June 9, 1903, showed a discharge of 22 second-feet. The drainage area of Boardman River above its mouth is estimated at 304 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Boardman River at Traverse City, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 18	Horton and Roundey	([a])	491
June 8	W. M. Gregory	([a])	370
July 14	do	3.21	383
July 23	Horton and Gregory	3.20	370
August 24	W. M. Gregory	3.28	402

[a] Gage not installed.

Mean daily gage height, in feet, of Boardman River at Traverse City, Mich., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.15	3.31	3.26	3.16	3.06	17	3.10	3.60	3.96	3.31	3.16	3.01
2	.....	3.10	3.11	3.36	3.26	2.91	18	3.15	3.30	3.81	3.21	3.26	3.06
3	.....	3.25	3.26	3.26	3.31	3.01	19	3.05	3.25	3.71	3.46	3.26	3.06
4	.....	3.95	3.21	3.16	3.21	3.16	20	3.20	3.25	3.31	3.36	3.16	2.96
5	.....	3.95	3.16	3.26	3.21	3.06	21	3.50	3.25	3.56	3.26	3.21	3.06
6	.....	3.95	3.16	3.41	3.26	3.06	22	3.50	3.35	3.51	3.31	2.91	3.06
7	.....	3.75	3.31	3.41	3.16	2.91	23	3.25	3.20	3.56	3.41	3.16	3.21
8	.....	3.45	3.41	3.51	3.21	3.16	24	3.15	4.56	3.46	3.26	3.06	3.06
9	.....	3.35	3.36	3.36	3.31	3.01	25	3.25	3.31	3.26	3.26	3.11	3.06
10	.....	3.45	3.36	3.16	3.26	3.06	26	3.35	3.26	3.11	3.31	3.16	3.11
11	.....	3.05	3.46	3.06	3.36	3.16	27	3.20	3.31	2.86	3.31	3.26	3.01
12	.....	3.30	3.31	3.26	3.16	2.96	28	3.15	3.31	3.26	3.26	3.06	3.21
13	.....	3.45	3.06	3.21	3.16	3.01	29	3.25	3.31	3.36	3.31	3.01	3.16
14	.....	3.65	3.41	3.11	3.31	3.06	30	3.25	3.36	3.11	3.26	3.16	3.06
15	.....	3.50	3.56	3.16	3.21	3.21	31	3.25	3.41	.....	3.36	.....	3.11
16	3.15	3.35	4.06	3.21	3.31	3.01							

MANISTEE RIVER AT SHERMAN, MICH.

Manistee River is the most northerly of the group of large rivers draining central Michigan and flowing westerly into Lake Michigan. The fall of the stream is very gradual, and no important utilization of water power has been made, the principal use of the stream being for rafting logs. Manistee, at the mouth of the river, affording an excellent harbor, is an important lumber center.

The drainage basin is sandy and receives a very large supply from ground storage through springs along the river bank and along the tributaries.

A chain gage was established at North Bridge, near Sherman, July 10, 1903. The stage of the stream is observed twice each day by Lincoln Jewell, and the record is furnished by citizens of Sherman. Current-meter discharge measurements are made at the bridge, which consists of a single span; the stream bed is of clay and sand and has some logs in it, as is frequently the case with rivers used for lumbering. It also becomes frozen over in the winter, so that the relation between the gage height and discharge is modified for that season.

Lumbermen's dams are located in sec. 10, T. 25 N., R. 5 W., and in sec. 6, T. 28 N., R. 4 W.

A discharge measurement was made at Maple Street Bridge, Manistee, Mich., March 19, 1903, by Robert E. Horton and E. P. Roundey. Volume of flow, 4,824 second-feet.

Wheeler Creek, entering Manistee River just below the gaging station, was measured July 24, 1903, by Robert E. Horton and W. M. Gregory; volume of flow, 16 second-feet at head of mill pond. Numer-

ous springs enter the stream near the gaging station. One of the larger of these had a discharge rate of 0.29 second-foot July 24, 1903.

Drainage areas of Manistee River.

	Sq. miles.
Manistee River above Sharon	421
Manistee River above junction Little Manistee River	1,751
Little Manistee River above mouth	267
Manistee River above mouth	2,018

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Manistee River at Sherman, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 4	W. M. Gregory	([a])	935
July 10	do	3.00	1,043
July 24	Horton and Gregory	3.00	1,050
Do	W. M. Gregory	3.05	1,060
August 26	do	2.85	994

[a] Gage not installed.

Mean daily gage height, in feet, of Manistee River at Sherman, Mich., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.00	3.55	3.15	3.05	3.00	17	2.88	3.30	3.75	3.45	3.45	[a] 3.85
2	.....	2.85	3.45	3.25	3.05	2.85	18	2.78	3.15	3.75	3.75	3.45	[a] 3.75
3	.....	2.95	3.35	3.25	3.05	2.85	19	2.68	2.95	3.65	3.75	3.35	[a] 3.75
4	.....	3.90	3.35	3.45	3.05	3.05	20	2.68	2.95	3.60	3.60	3.20	3.40
5	.....	4.75	3.25	3.35	3.05	3.05	21	2.85	2.85	3.45	3.50	3.15	3.25
6	.....	4.75	3.25	3.35	3.05	3.05	22	3.10	2.85	3.35	3.35	3.15	3.15
7	.....	4.40	3.25	3.35	3.05	3.05	23	3.15	2.75	3.30	3.25	3.25	3.15
8	.....	4.10	3.35	3.35	3.15	3.05	24	3.00	2.75	3.25	3.25	3.20	3.15
9	.....	3.80	3.40	3.45	3.35	3.05	25	3.05	2.85	3.15	3.15	3.10	3.05
10	3.10	3.55	3.60	3.35	3.30	3.15	26	3.00	2.85	3.10	3.15	3.00	[a] 3.15
11	3.00	3.50	3.65	3.35	3.15	3.00	27	2.95	2.85	3.15	3.15	2.95	[a] 5.15
12	2.95	3.50	3.65	3.35	3.55	2.85	28	3.00	2.90	3.15	3.05	2.90	[a] 4.40
13	2.90	3.60	3.55	3.25	3.55	[a] 4.25	29	3.30	3.15	3.15	3.05	2.95	4.35
14	2.90	3.55	3.65	3.15	3.55	[a] 4.00	30	3.25	3.45	3.15	3.05	3.00	4.30
15	2.88	3.45	3.65	3.15	3.55	[a] 3.90	31	3.10	3.50	.....	3.05	.....	4.15
16	2.88	3.35	3.75	3.20	3.45	[a] 3.85							

[a] Ice obstruction causing backwater.

MUSKEGON RIVER AT NEWAYGO, MICH.

A gaging station was established at the dam of the Newaygo Portland Cement Company, April, 1901. The crest gage is attached to a crib 50 feet upstream from the center of the dam. The dam contains a fishway 17 feet in length, 4 Taintor flood gates of 20 feet each, a spillway 20 feet in length, a logway 21.5 feet in length, and a main overflow 98.6 feet in length. A record is kept of the depth on the crest gage and on a tailrace gage having its datum 9 feet lower, and of the opening and closing of the logway and flood gates. The hours of running of the three sets of 35-inch horizontal Samson turbines in the adjacent power plant, and the gate opening at which they are operated, are also recorded.

A survey of the dam was made and tests of the turbine discharge were taken by current meter August 29, 1902. The daily discharge has not been calculated from the record. The gaging station is maintained through the cooperation of the Newaygo Portland Cement Company, and the record is kept by E. N. Hanlon, C. E.

GRAND RIVER AT GRAND RAPIDS, MICH.

Grand River rises in northern Hillsdale County, in the vicinity of Bunday Hills. The headwaters of the Kalamazoo, St. Joseph, Raisin, and northern branches of the Maumee River are in this same locality. Its principal tributaries are Flat, Maple, Lookingglass, and Cedar rivers from the north and Thornapple River from the south. Water power is extensively developed on the main stream and on certain of these tributaries. The drainage area is flat or moderately rolling, and comprises alternate areas of sand, loam, and clay. It is largely under cultivation, isolated timber areas remaining. Numerous small lakes and undrained hollows are located in the northwestern and southeastern parts of the drainage basin.

The station was established March 12, 1901, by L. W. Anderson, city engineer of Grand Rapids, Mich. The gage is attached to the upstream end of the ice breaker of the left bridge pier. The elevation of its zero is 0.55 foot below the city datum. All gage heights have been expressed as elevations above the city datum. Discharge measurements are made from the Fulton street bridge at which the gage is located. The channel is straight for several hundred feet above and below the bridge and is broken by three bridge piers. The gaging section is shallow and the bed is composed of cobblestones and gravel. The current is rapid and the velocity is poorly distributed at low stages.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily gage height, in feet, of Grand River at Grand Rapids, Mich., for 1903. [a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	2.50	2.55	0.90	0.82	0.25	3.35	3.85	0.75	0.55
2	3.32	7.60	6.90	2.40	2.15	.75	.65	.....	3.30	3.65	.60	.35
3	3.50	7.72	7.35	2.45	.....	.65	.60	−.15	3.10	4.10	.55	.35
4	.....	8.15	7.75	2.45	1.80	.45	.....	−.05	2.75	4.55	.55	.40
5	3.52	8.15	8.25	.....	1.60	.30	.....	.30	2.35	3.70	.45	.35
6	3.45	7.55	8.85	2.55	1.50	.20	.72	.45	2.00	4.20	.45	.....
7	3.55	7.02	9.52	2.95	1.40	.....	.55	.55	1.90	4.95	.45	.45
8	3.78	.....	.....	3.30	1.20	.18	.35	.60	1.70	4.60	.....	.30
9	4.18	6.25	.....	3.45	1.10	.18	.30	.....	1.60	4.25	.40	.30
10	4.38	5.60	.....	3.30	.....	.25	.20	.50	1.80	4.10	.40	.40
11	.....	4.90	.....	3.10	.90	.40	.00	.35	2.05	4.00	.35	.40
12	4.78	4.70	.....	.....	.80	.30	.....	.20	2.00	3.72	.45	.25
13	4.90	4.55	.....	5.45	.70	.05	−.25	.10	1.75	3.35	.45	.....
14	5.08	4.65	.....	7.05	.75	.....	−.15	.05	1.60	2.95	.55	1.30
15	5.28	.....	.....	8.30	.60	.05	−.30	−.10	1.40	2.75	.....	1.05
16	5.45	5.35	.....	9.65	.50	−.12	−.55	.....	1.30	2.85	.85	1.05
17	5.32	5.82	.....	11.00	.....	−.08	−.45	−.30	1.50	2.60	.95	1.10
18	.....	7.98	.....	11.15	.40	.15	.00	−.25	1.90	2.25	.95	.90
19	4.58	7.80	.....	.....	.40	−.15	.....	−.35	2.00	2.15	.95	1.10
20	4.00	7.45	.....	9.80	.30	.08	.35	−.25	2.05	1.95	.90	.....
21	3.38	7.25	.....	8.70	.30	.....	.35	−.40	2.20	1.80	.65	.95
22	3.02	.....	.....	7.55	.55	.35	.45	−.40	2.65	1.65	.....	.85
23	2.95	5.85	5.05	6.50	.55	.90	.50	.....	3.60	1.35	.65	.75
24	2.62	5.35	4.45	5.40	.....	1.30	.50	.00	3.72	1.25	.75	.80
25	.....	4.70	4.05	5.50	.65	1.50	.40	.35	3.55	1.05	.70	.....
26	2.00	4.22	3.90	.....	.85	1.80	.....	.45	3.35	1.05	.10	1.40
27	2.08	4.00	3.82	4.05	1.65	1.55	.30	.70	2.85	1.05	.35	.....
28	2.05	5.20	3.65	3.55	1.85	.....	.10	2.00	2.70	1.05	.15	1.75
29	3.15	.....	.....	3.25	1.70	1.15	.28	2.25	2.72	.95	.....	1.80
30	5.78	.....	3.00	2.85	.....	.88	.15	3.25	3.50	.85	.55	1.70
31	6.70	.....	2.65	.....	.....	.....	.25	3.25	.....	.80	.....	1.65

[a] No record on dates left blank. Height above or below city datum.

Rating table for Grand River at Grand Rapids, Mich., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.00	1,885	.95	3,140	2.90	5,885	4.85	8,800
− .05	1,820	1.00	3,205	2.95	5,960	4.90	8,875
− .10	1,755	1.05	3,270	3.00	6,035	4.95	8,950
− .15	1,690	1.10	3,335	3.05	6,110	5.00	9,025
− .20	1,625	1.15	3,400	3.10	6,180	5.05	9,100
− .25	1,560	1.20	3,470	3.15	6,250	5.10	9,180
− .30	1,495	1.25	3,540	3.20	6,325	5.15	9,260
− .35	1,430	1.30	3,605	3.25	6,400	5.20	9,335
− .40	1,370	1.35	3,670	3.30	6,470	5.25	9,410
− .45	1,310	1.40	3,745	3.35	6,540	5.30	9,490
− .50	1,245	1.45	3,820	3.40	6,610	5.35	9,570
− .55	1,180	1.50	3,890	3.45	6,680	5.40	9,670
− .60	1,110	1.55	3,960	3.50	6,760	5.45	9,770
− .65	1,040	1.60	4,030	3.55	6,840	5.50	9,850
− .70	980	1.65	4,100	3.60	6,910	5.55	9,930
− .75	920	1.70	4,170	3.65	6,980	5.60	10,015
− .80	860	1.75	4,240	3.70	7,055	5.65	10,100
− .85	800	1.80	4,310	3.75	7,130	5.70	10,185
− .90	730	1.85	4,380	3.80	7,205	5.75	10,270
− .95	660	1.90	4,450	3.85	7,280	5.80	10,350
.00	1,885	1.95	4,520	3.90	7,355	5.85	10,430
.05	1,950	2.00	4,590	3.95	7,430	5.90	10,515
.10	2,015	2.05	4,660	4.00	7,505	5.95	10,600
.15	2,080	2.10	4,730	4.05	7,580	6.00	10,685
.20	2,140	2.15	4,800	4.10	7,655	6.05	10,770
.25	2,200	2.20	4,870	4.15	7,730	6.10	10,850
.30	2,265	2.25	4,940	4.20	7,805	6.15	10,930
.35	2,330	2.30	5,010	4.25	7,880	6.20	11,015
.40	2,405	2.35	5,080	4.30	7,955	6.25	11,100
.45	2,480	2.40	5,155	4.35	8,030	6.30	11,180
.50	2,545	2.45	5,230	4.40	8,105	6.35	11,260
.55	2,610	2.50	5,305	4.45	8,180	6.40	11,380
.60	2,675	2.55	5,380	4.50	8,255	6.45	11,500
.65	2,740	2.60	5,450	4.55	8,330	6.50	11,590
.70	2,810	2.65	5,520	4.60	8,410	6.55	11,680
.75	2,880	2.70	5,595	4.65	8,490	6.60	11,770
.80	2,945	2.75	5,670	4.70	8,565	6.65	11,860
.85	3,010	2.80	5,740	4.75	8,640	6.70	11,950
.90	3,075	2.85	5,810	4.80	8,720	6.75	12,040

Rating table for Grand River at Grand Rapids, Mich., from January 1 to December 31, 1903—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.80	12,130	8.75	15,910	10.70	19,945	12.65	23,980
6.85	12,220	8.80	16,015	10.75	20,050	12.70	24,085
6.90	12,310	8.85	16,120	10.80	20,155	12.75	24,190
6.95	12,400	8.90	16,220	10.85	20,260	12.80	24,295
7.00	12,490	8.95	16,320	10.90	20,360	12.85	24,400
7.05	12,580	9.00	16,425	10.95	20,460	12.90	24,500
7.10	12,670	9.05	16,530	11.00	20,565	12.95	24,600
7.15	12,760	9.10	16,635	11.05	20,670	13.00	24,705
7.20	12,850	9.15	16,740	11.10	20,775	13.05	24,810
7.25	12,940	9.20	16,840	11.15	20,880	13.10	24,915
7.30	13,030	9.25	16,940	11.20	20,980	13.15	25,020
7.35	13,120	9.30	17,045	11.25	21,080	13.20	25,120
7.40	13,250	9.35	17,150	11.30	21,185	13.25	25,220
7.45	13,380	9.40	17,255	11.35	21,290	13.30	25,325
7.50	13,470	9.45	17,360	11.40	21,395	13.35	25,430
7.55	13,560	9.50	17,460	11.45	21,500	13.40	25,535
7.60	13,650	9.55	17,560	11.50	21,600	13.45	25,640
7.65	13,750	9.60	17,665	11.55	21,700	13.50	25,740
7.70	13,840	9.65	17,770	11.60	21,805	13.55	25,840
7.75	13,930	9.70	17,875	11.65	21,910	13.60	25,945
7.80	14,025	9.75	17,980	11.70	22,015	13.65	26,050
7.85	14,120	9.80	18,085	11.75	22,120	13.70	26,155
7.90	14,210	9.85	18,190	11.80	22,225	13.75	26,260
7.95	14,300	9.90	18,290	11.85	22,330	13.80	26,365
8.00	14,390	9.95	18,390	11.90	22,430	13.85	26,470
8.05	14,480	10.00	18,495	11.95	22,530	13.90	26,570
8.10	14,580	10.05	18,600	12.00	22,635	13.95	26,670
8.15	14,680	10.10	18,705	12.05	22,740	14.00	26,775
8.20	14,785	10.15	18,810	12.10	22,845	14.05	26,880
8.25	14,890	10.20	18,910	12.15	22,950	14.10	26,985
8.30	14,995	10.25	19,010	12.20	23,050	14.15	27,090
8.35	15,100	10.30	19,115	12.25	23,150	14.20	27,195
8.40	15,200	10.35	19,220	12.30	23,255	14.25	27,300
8.45	15,300	10.40	19,325	12.35	23,360	14.30	27,410
8.50	15,400	10.45	19,430	12.40	23,465	14.35	27,520
8.55	15,500	10.50	19,530	12.45	23,570	14.40	27,625
8.60	15,605	10.55	19,630	12.50	23,670	14.45	27,730
8.65	15,710	10.60	19,735	12.55	23,770	14.50	27,835
8.70	15,810	10.65	19,840	12.60	23,875	14.55	27,940

Rating table for Grand River at Grand Rapids, Mich., from January 1 to December 31, 1903—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
14.60	28,045	15.00	28,895	15.40	29,770	15.80	30,650
14.65	28,150	15.05	29,000	15.45	29,880	15.85	30,760
14.70	28,255	15.10	29,110	15.50	29,990	15.90	30,870
14.75	28,360	15.15	29,220	15.55	30,100	15.95	30,980
14.80	28,470	15.20	29,330	15.60	30,110	16.00	31,090
14.85	28,580	15.25	29,440	15.65	30,320	16.05	31,200
14.90	28,685	15.30	29,550	15.70	30,430		
14.95	28,790	15.35	29,660	15.75	30,540		

Mean daily discharge, in second-feet, of Grand River at Grand Rapids, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	(a)	(a)	5,305	5,380	3,075	2,980	2,200	6,540	7,280	2,880	2,610
2	6,505	13,650	12,310	5,155	4,800	2,880	2,740	(a)	6,470	6,980	2,675	2,330
3	6,760	13,885	13,120	5,230	(a)	2,740	2,675	1,690	6,180	7,655	2,610	2,330
4	(a)	14,680	13,930	5,230	4,310	2,480	(a)	1,820	5,670	8,330	2,610	2,405
5	6,800	14,680	14,890	(a)	4,030	2,265	(a)	2,265	5,080	7,055	2,480	2,330
6	6,680	13,560	16,120	5,380	3,890	2,140	2,840	2,480	4,590	7,805	2,480	(a)
7	6,840	12,535	17,510	5,960	3,745	(a)	2,610	2,610	4,450	8,950	2,480	2,480
8	7,170	(a)	(a)	6,470	3,470	2,110	2,330	2,675	4,170	8,410	(a)	2,265
9	7,770	11,100	(a)	6,680	3,335	2,110	2,265	(a)	4,030	7,880	2,405	2,265
10	8,060	10,015	.....	6,470	(a)	2,200	2,140	2,545	4,310	7,655	2,405	2,405
11	(a)	8,875	.....	6,180	3,075	2,405	1,885	2,330	4,660	7,505	2,330	2,405
12	8,680	8,565	.....	(a)	2,945	2,265	(a)	2,140	4,590	7,090	2,480	2,200
13	8,875	8,330	.....	9,770	2,810	1,950	1,560	2,015	4,240	6,540	2,480	(a)
14	9,140	8,490	.....	12,580	2,880	(a)	1,690	1,950	4,030	5,960	2,610	3,605
15	9,450	(a)	.....	14,995	2,675	1,950	1,495	1,755	3,745	5,670	(a)	3,270
16	9,770	9,570	.....	17,770	2,545	1,720	1,180	(a)	3,605	5,810	3,010	3,270
17	9,530	10,390	.....	20,565	(a)	1,790	1,310	1,495	3,890	5,450	3,140	3,335
18	(a)	14,345	.....	20,880	2,405	2,080	1,885	1,560	4,450	4,940	3,140	3,075
19	8,370	14,025	.....	(a)	2,405	1,690	(a)	1,430	4,590	4,800	3,140	3,335
20	7,505	13,380	.....	18,085	2,265	1,985	2,330	1,560	4,660	4,520	3,075	(a)
21	6,580	12,940	.....	15,810	2,265	(a)	2,330	1,370	4,870	4,310	2,740	3,140
22	6,070	(a)	.....	13,560	2,610	2,330	2,480	1,370	5,520	4,100	(a)	3,010
23	5,960	10,430	9,100	11,590	2,610	3,075	2,545	(a)	6,910	3,670	2,740	2,880
24	5,485	9,570	8,180	9,670	(a)	3,605	2,545	1,885	7,090	3,540	2,880	2,945
25	(a)	8,565	7,580	9,850	2,740	3,890	2,405	2,330	6,840	3,270	2,810	(a)
26	4,590	7,840	7,355	(a)	3,010	4,310	(a)	2,480	6,540	3,270	2,015	3,745
27	4,695	7,505	7,240	7,580	4,100	3,960	2,265	2,810	5,810	3,270	2,330	(a)
28	4,660	9,335	6,980	6,840	4,380	(a)	2,015	4,590	5,595	3,270	2,080	4,240
29	6,250	.....	(a)	6,400	4,170	3,400	2,230	4,940	5,640	3,140	(a)	4,310
30	10,310	.....	6,035	5,810	(a)	3,040	2,280	6,400	6,760	3,010	2,610	4,170
31	11,950	.....	5,520	.....	(a)	.....	2,200	6,400	.....	2,945	.....	4,100
Mean	7,479	11,094	10,419	9,993	3,314	2,594	2,200	2,559	5,184	5,615	2,640	3,018

a No record.

Estimated monthly discharge of Grand River at Grand Rapids, Mich., for 1903.

[Drainage area, 4,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	11,950	4,590	7,479	1.53	1.76
February	14,680	7,505	11,094	2.26	2.35
March 2-7, 23-28, 30, 31	.....	.....	10,419	2.13	2.46
April	20,880	5,155	9,993	2.04	2.28
May	5,380	2,265	3,314	.68	.78
June	4,310	1,690	2,594	.53	.59
July	2,980	1,180	2,200	.45	.52
August	6,400	1,370	2,559	.52	.60
September	7,090	3,605	5,184	1.06	1.18
October	8,950	2,945	5,615	1.15	1.33
November	3,140	2,015	2,640	.54	.60
December	4,310	2,200	3,018	.62	.71

CROCKERY CREEK AT SLOCUMS GROVE, MICH.

Crockery Creek is a tributary of Grand River, Michigan. It rises in T. 11 N., R. 13 W., and flows southerly through central Muskegon County, entering Grand River 10 miles from Lake Michigan. A gaging station was established at the Toledo, Saginaw and Muskegon (Pere Marquette system) Railroad bridge at Slocum station, on the north branch of the stream, October 1, 1902. The gaging station was established in cooperation with Charles W. Garfield, president of the State forestry commission, and Walter C. Winchester, of the Foster-Winchester Lumber Company, of Grand Rapids. The gage scale is attached vertically to the bridge piling on the left-hand end, downstream side of the bridge. December 6, 1902, the record was discontinued for the winter, owing to obstruction of the stream channel by ice.

The bench mark is the top of the timber pile coping over the gage; elevation, 100 feet. The elevation of the zero of the gage is 82.43 feet.

The gage is located about 1,000 feet below a dam forming a log pond for the Foster-Winchester sawmill. The pond level is regulated by flashboards, and the flow past the gage varies accordingly.

The length of the stream above the gaging station is about 10 miles. Beginning at Slocum, extending upstream and covering an aggregate area of between 5,000 and 6,000 acres, is a hard-wood and hemlock forest which is now being lumbered. The remainder of the basin is mostly cleared and much is under cultivation. The soil is sandy, and

after the timber is cut the hitherto forest-covered area rapidly grows up to brush and shrubs, so that the soil is shaded and protected much as in the original forest.

Aside from the lumbering dam at Slocum, there are no lakes or dams within the basin above the point of gaging.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily gage height, in feet, of Crockery Creek at Slocum Grove, Mich., for 1903.

Day.	Apr.	May.	June.	Day.	Apr.	May	June.	Day.	Apr.	May.	June.
1	1.70	1.30	1.50	12	1.90	1.00	1.70	23	1.50	1.10	1.50
2	2.00	1.20	1.50	13	2.10	.80	1.60	24	1.30	.80	1.00
3	1.50	1.20	1.30	14	3.20	1.10	1.70	25	1.30	1.10	1.40
4	1.40	.90	1.00	15	3.20	1.00	1.80	26	1.20	2.00	1.60
5	1.40	1.40	1.60	16	2.70	.90	1.70	27	1.30	2.40	1.60
6	1.40	1.30	1.60	17	2.80	.80	1.70	28	1.10	2.60	.....
7	1.30	1.20	1.70	18	2.60	.80	1.80	29	1.50	2.30	.....
8	1.20	1.00	1.60	19	2.10	1.00	1.40	30	1.60	2.00	.....
9	1.20	1.10	1.60	20	1.80	.70	1.60	31	.....	1.40	.....
10	1.00	1.00	1.50	21	1.10	.70	1.70				
11	1.30	.90	1.60	22	1.00	1.40	1.40				

GRAND RIVER AT NORTH LANSING, MICH.

This station was established March 2, 1901, by H. K. Vedder. It is located at the Seymour Street Bridge a short distance below the North Lansing dam. About November 8, 1901, a low, submerged dam was constructed a short distance downstream from the gaging station to supply water to the factory of the Michigan Beet Sugar Company. The diversion at this point is small compared with the flow of the stream. In order to determine the effect of the submerged dam on the gage readings a second gage was established a short distance downstream and comparative readings were taken. The gage readings made prior to the construction of the dam have been corrected from the data thus obtained. The vertical gage is attached to the downstream end of the central pier of the bridge. It is read twice each day by Thomas Costigan. Discharge measurements are made from the two-span bridge to which the gage is attached. Each span has a length of 92 feet. During low water the bridge makes a slight angle with the normal to the direction of the current, at one side of the stream. The bed of the stream is composed of gravel and silt and is thickly overgrown with weeds above the bridge. The current becomes sluggish at low stages. The channel is nearly straight for 200 feet above and below the station.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Grand River at North Lansing, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 4	Horton and Roundey	8.38	4,546
March 9	E. P. Roundey	10.08	6,604
March 10	do	9.65	6,308
May 14	W. M. Gregory	2.62	605
September 1	do	5.60	1,850
June —	H. K. Vedder	2.53	521

Mean daily gage height, in feet, of Grand River at North Lansing, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	6.76	7.82	3.81	3.78	2.29	2.50	2.88	5.58	2.95	2.15	1.85
2	3.38	6.48	8.30	3.78	3.50	2.28	2.39	2.86	5.38	3.08	2.10	1.75
3	3.55	6.12	8.46	4.05	3.42	2.05	2.90	3.15	4.89	2.95	2.15	1.85
4	3.89	5.65	8.30	4.52	3.66	2.04	2.71	3.32	4.40	3.15	2.10	2.05
5	4.05	5.10	8.08	5.38	3.70	2.02	2.76	3.85	4.04	3.30	2.15	2.25
6	3.95	4.81	8.08	5.98	3.59	1.90	2.58	4.18	3.66	3.15	2.35	1.82
7	3.92	4.49	8.80	6.47	3.40	2.20	2.59	3.85	3.46	3.80	2.32	1.85
8	3.82	4.18	10.22	6.25	3.25	3.05	2.52	3.62	3.05	4.75	2.12	1.75
9	3.40	4.04	10.24	5.62	3.08	3.02	2.42	3.51	2.98	4.60	2.28	1.85
10	3.30	4.08	9.58	4.98	3.10	2.80	2.42	3.25	3.10	4.24	2.15	2.05
11	3.40	4.16	9.02	4.90	2.88	2.35	2.26	3.22	2.85	3.92	2.25	2.35
12	3.25	4.61	8.55	6.82	2.68	2.22	2.41	3.08	2.80	3.82	2.35	2.45
13	3.45	5.08	8.00	8.20	2.56	2.14	2.40	2.95	2.90	3.55	3.20	1.95
14	3.19	5.68	7.52	10.06	2.30	2.29	2.00	2.96	3.20	3.25	2.95	2.25
15	3.08	5.60	6.98	11.34	2.28	2.12	2.40	3.05	3.60	3.15	2.68	2.15
16	2.99	5.25	6.52	11.18	2.45	2.02	2.09	2.98	4.50	2.95	2.59	2.05
17	2.95	5.18	6.26	10.02	2.30	1.88	1.75	3.08	5.65	2.78	2.70	1.95
18	3.04	5.08	6.14	8.75	2.11	1.94	2.68	2.78	6.24	2.82	3.58	1.85
19	3.08	4.95	5.95	7.70	2.05	2.05	3.54	2.65	6.15	2.72	3.52	1.95
20	2.90	4.80	5.68	6.80	2.06	2.19	3.55	2.75	5.75	2.64	3.15	2.00
21	2.82	4.45	5.31	6.15	2.02	2.42	3.34	2.88	5.20	2.65	2.75	2.05
22	2.78	4.08	5.05	5.60	1.98	2.42	3.19	2.45	4.70	2.55	2.42	2.15
23	2.66	4.02	4.99	5.26	2.19	3.25	3.38	2.50	4.50	2.75	2.65	2.05
24	2.62	3.90	4.92	5.02	2.70	4.05	3.40	3.08	3.90	2.42	2.55	2.25
25	2.68	3.79	4.84	4.95	2.75	3.88	3.39	3.62	3.68	2.60	2.50	2.42
26	2.61	3.62	4.55	5.12	2.92	3.65	3.28	3.78	3.45	2.68	2.35	2.95
27	2.68	3.56	4.40	4.95	2.86	3.30	3.12	3.80	3.40	2.55	2.25	2.80
28	3.14	5.75	4.28	4.65	2.82	3.10	3.18	4.70	3.32	2.52	2.15	2.78
29	5.65	.....	4.22	4.45	2.55	2.78	3.29	5.50	3.21	2.35	1.95	2.46
30	7.30	.....	4.09	4.10	2.60	2.62	3.16	5.98	3.00	2.35	2.00	2.35
31	7.25	.....	3.96	.....	2.45	.....	3.10	5.90	.....	2.20	.....	2.22

Rating table for Grand River at North Lansing, Mich., from March 3, 1901, to December 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	80	3.60	980	6.20	2,540	8.80	5,110
1.10	108	3.70	1,030	6.30	2,610	8.90	5,250
1.20	136	3.80	1,080	6.40	2,690	9.00	5,380
1.30	164	3.90	1,130	6.50	2,760	9.10	5,530
1.40	192	4.00	1,180	6.60	2,840	9.20	5,680
1.50	220	4.10	1,230	6.70	2,920	9.30	5,820
1.60	248	4.20	1,290	6.80	3,010	9.40	5,970
1.70	276	4.30	1,340	6.90	3,090	9.50	6,120
1.80	304	4.40	1,400	7.00	3,170	9.60	6,300
1.90	332	4.50	1,450	7.10	3,260	9.70	6,480
2.00	360	4.60	1,510	7.20	3,350	9.80	6,650
2.10	392	4.70	1,570	7.30	3,450	9.90	6,830
2.20	424	4.80	1,630	7.40	3,540	10.00	7,010
2.30	456	4.90	1,690	7.50	3,630	10.10	7,210
2.40	488	5.00	1,750	7.60	3,730	10.20	7,410
2.50	520	5.10	1,810	7.70	3,830	10.30	7,610
2.60	558	5.20	1,870	7.80	3,930	10.40	7,810
2.70	596	5.30	1,940	7.90	4,030	10.50	8,000
2.80	634	5.40	2,000	8.00	4,130	10.60	8,200
2.90	672	5.50	2,060	8.10	4,250	10.70	8,400
3.00	710	5.60	2,130	8.20	4,360	10.80	8,600
3.10	754	5.70	2,190	8.30	4,480	10.90	8,800
3.20	798	5.80	2,260	8.40	4,590	11.00	9,000
3.30	842	5.90	2,320	8.50	4,710		
3.40	886	6.00	2,390	8.60	4,840		
3.50	930	6.10	2,460	8.70	4,980		

Gage read to ½-tenths feet; discharge taken out from means to ¼ tenths; discharge corrected from special measurements for obstruction by beet-sugar dam when necessary.

[a] From March 3 to November 10, 1901, inclusive, only applicable to corrected gage heights.

Mean daily discharge, in second-feet, of Grand River at North Lansing, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	842	2,965	3,955	1,080	1,068	456	520	662	2,112	691	408	318
2	875	2,742	4,480	1,068	930	448	488	653	1,985	743	392	290
3	955	2,442	4,670	1,205	897	376	672	776	1,690	691	408	318
4	1,130	2,160	4,480	1,465	1,005	376	596	853	1,400	776	392	376
5	1,205	1,810	4,220	1,985	1,030	368	615	1,105	1,205	842	408	440
6	1,155	1,630	4,220	2,372	980	332	548	1,275	1,005	776	472	301
7	1,155	1,450	5,110	2,742	886	424	558	1,105	908	1,080	464	318
8	1,092	1,275	7,460	2,575	820	732	530	992	732	1,600	400	290
9	886	1,205	7,510	2,145	743	721	496	930	700	1,510	448	318
10	842	1,218	6,255	1,735	754	634	496	820	754	1,315	408	376
11	886	1,260	5,418	1,690	662	472	440	809	653	1,142	440	472
12	820	1,510	4,775	3,030	586	432	488	743	634	1,092	472	504
13	908	1,795	4,130	4,360	539	408	488	691	672	955	798	346
14	798	2,175	3,655	7,110	456	456	360	691	798	820	691	440
15	743	2,130	3,150	a9,800	448	400	488	732	980	776	586	408
16	710	1,905	2,780	a9,400	504	368	392	700	1,450	691	558	376
17	691	1,855	2,575	7,060	456	325	290	743	2,160	624	596	346
18	732	1,795	2,500	5,045	392	346	586	624	2,575	644	968	318
19	743	1,720	2,355	3,830	376	376	955	577	2,500	606	942	346
20	672	1,630	2,175	3,010	376	424	955	615	2,225	577	776	360
21	644	1,425	1,940	2,500	368	496	864	662	1,870	577	615	376
22	624	1,218	1,780	2,130	353	496	798	504	1,570	539	496	408
23	577	1,192	1,750	1,905	424	820	875	520	1,450	615	577	376
24	568	1,130	1,705	1,765	596	1,205	886	743	1,130	496	539	440
25	586	1,080	1,660	1,720	615	1,118	886	992	1,018	558	520	496
26	558	992	1,480	1,825	682	1,005	831	1,068	908	586	472	691
27	586	955	1,400	1,720	653	842	765	1,080	886	539	440	634
28	776	2,225	1,328	1,540	644	754	787	1,570	853	530	408	624
29	2,160	.....	1,302	1,425	539	624	842	2,060	798	472	346	504
30	3,450	.....	1,230	1,230	558	568	776	2,372	710	472	360	472
31	3,400	.....	1,155	.....	504	.....	754	2,320	.....	424	.....	432
Mean	1,025	1,674	3,310	3,016	640	560	646	969	1,278	766	527	410

a Estimated by logarithmic extension of rating curve.

Estimated monthly discharge of Grand River at North Lansing, Mich., for 1903.

[Drainage area, 1,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	3,450	558	1,025	0.83	0.95
February	2,965	955	1,674	1.36	1.41
March	7,510	1,155	3,310	2.69	3.10
April	9,800	1,068	3,016	2.45	2.73
May	1,068	353	640	.52	.60
June	1,205	325	560	.46	.52
July	955	290	646	.53	.61
August	2,372	504	969	.79	.91
September	2,575	634	1,278	1.04	1.16
October	1,600	424	766	.62	.71
November	968	346	527	.43	.48
December	691	290	410	.33	.38
The year	9,800	290	1,235	1.00	13.56

RED CEDAR RIVER AT AGRICULTURAL COLLEGE, MICH.

This gaging station was established August 30, 1902. The gage is located at the highway bridge just below the Agricultural College grounds. The bridge has a single span of 75 feet between abutments. The bed is of sand and gravel, fairly smooth and permanent. The channel is straight for a distance of about 400 feet downstream from the gage. A short distance upstream is a low dam forming an ice pond, below which the stream does not ordinarily freeze over. In this stretch of the river is the railroad bridge of the college spur of the Pere Marquette Railroad, from which gagings are made at high water or when the stream is frozen across at the gaging station. Near this bridge low-water measurements are also made by wading. The gage is of the usual wire type, and is attached to the downstream guard rail of the bridge. The upstream corner of the right-hand wing wall of the bridge abutment is used as a bench mark, with an arbitrary elevation of 100 feet. The elevation of the datum plane of the gage is 85.45 feet. The gage is read twice each day by Clifford Walters. The gaging station is situated about 4 miles from the mouth of the stream. Sycamore Creek, an important tributary, enters in this section. The drainage area above the gaging station is 358 square miles, and from the gaging station to the mouth of the stream 114 square miles, making the total above Grand River 472 square miles. The flow is sluggish at low stage and the station is subject to backwater from the Grand River.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Red Cedar River at Agricultural College, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 3	Horton and Roundey	9.75	[a] 1,734
March 4	do	9.48	[a] 1,516
March 8	E. P. Roundey	9.45	[b] 2,062
May 15	Lane and Gregory	2.72	112
June 30	W. M. Gregory	2.98	130
September 1	do	7.10	841

[a] At Flint and Pere Marquette Railroad bridge, Agricultural College grounds. River frozen 7 to 12 inches at gage.
[b] Approximate.

Mean daily gage height, in feet, of Red Cedar River at Agricultural College, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	8.65	9.70	3.70	3.70	2.32	2.78	2.42	7.10	3.18	2.65	2.80
2	4.03	8.27	9.63	3.78	3.60	2.40	3.47	2.38	6.80	3.20	2.52	2.90
3	4.32	7.88	9.62	4.35	3.55	2.37	4.27	2.40	6.18	3.18	2.70	2.75
4	5.02	7.50	9.56	5.20	4.15	2.37	3.70	2.70	5.45	3.28	2.68	2.72
5	5.48	6.92	9.25	5.87	3.95	2.30	3.30	3.42	4.75	3.48	2.65	2.65
6	5.38	6.40	9.17	6.60	3.72	2.27	2.95	3.82	4.10	3.30	2.60	2.68
7	5.13	6.05	9.00	7.48	3.52	2.25	2.82	3.48	3.68	3.55	2.60	2.50
8	4.78	5.30	9.42	6.87	3.35	2.15	2.65	3.18	3.48	4.48	2.70	2.75
9	4.25	4.93	9.35	5.91	3.25	2.32	2.55	2.88	3.45	4.92	2.52	2.70
10	4.23	5.00	8.97	5.22	3.10	2.35	2.47	2.62	3.35	4.52	2.62	2.68
11	4.13	5.38	8.85	5.07	2.92	2.45	2.40	2.68	3.32	4.10	2.60	2.65
12	3.98	6.35	8.68	7.67	2.82	2.35	2.35	2.50	3.18	3.85	3.18	2.70
13	3.83	7.33	8.15	8.85	2.75	2.30	2.22	2.40	3.10	3.62	3.85	2.65
14	3.80	7.62	7.60	9.55	2.70	2.55	2.18	2.32	3.30	3.48	3.75	2.72
15	3.78	7.18	6.87	10.07	2.67	2.40	2.08	2.00	4.25	3.35	3.55	2.65
16	3.70	5.85	6.45	10.02	2.65	2.42	1.98	2.22	6.22	3.30	3.58	2.85
17	3.75	5.47	6.15	9.55	2.57	2.50	1.88	2.10	7.15	3.30	4.02	2.95
18	3.73	5.23	5.92	8.80	2.45	2.70	2.35	2.18	8.10	3.20	4.05	3.00
19	3.63	4.80	5.60	7.95	2.62	2.62	3.60	2.18	7.82	3.15	3.75	2.90
20	3.55	4.25	5.45	7.12	2.75	2.90	3.58	2.30	7.00	3.10	3.35	2.92
21	3.50	4.22	5.10	6.18	2.55	3.27	3.40	1.95	6.32	3.05	3.50	2.90
22	3.48	4.10	4.75	5.45	2.62	3.45	3.62	2.08	5.75	2.92	3.42	3.18
23	3.40	4.03	4.50	4.92	2.72	4.85	3.97	1.88	5.08	2.90	3.25	3.20
24	3.43	3.98	4.60	4.70	3.10	5.70	3.70	2.38	4.40	2.82	3.32	3.20
25	3.35	3.92	4.50	5.10	3.15	5.45	3.32	2.92	3.90	2.72	3.28	3.25
26	3.38	3.90	4.42	5.35	3.12	5.02	3.02	3.15	3.58	2.70	3.30	3.20
27	3.55	4.37	4.28	5.02	3.12	4.50	2.82	3.35	3.52	2.78	3.12	3.20
28	4.60	8.16	4.40	4.60	3.15	3.87	2.70	4.90	3.60	2.75	2.95	3.10
29	7.68	.....	4.22	4.20	2.87	3.35	2.80	6.08	3.40	2.72	2.95	3.22
30	9.13	.....	4.05	3.82	2.65	3.00	2.68	6.82	3.25	2.75	2.72	3.25
31	9.23	.....	3.85	.....	2.55	.....	2.52	7.12	.....	2.70	.....	3.22

Rating table for Red Cedar River at Agricultural College, Mich., from August 31, 1902, to December 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	15	3.40	179	5.30	451	7.20	887
1.55	18	3.45	184	5.35	460	7.25	902
1.60	22	3.50	190	5.40	468	7.30	918
1.65	26	3.55	196	5.45	476	7.35	934
1.70	29	3.60	202	5.50	485	7.40	949
1.75	32	3.65	208	5.55	494	7.45	964
1.80	36	3.70	214	5.60	504	7.50	980
1.85	40	3.75	220	5.65	514	7.55	1,000
1.90	43	3.80	226	5.70	523	7.60	1,020
1.95	46	3.85	232	5.75	532	7.65	1,040
2.00	50	3.90	238	5.80	542	7.70	1,060
2.05	54	3.95	244	5.85	552	7.75	1,080
2.10	58	4.00	250	5.90	561	7.80	1,100
2.15	61	4.05	257	5.95	570	7.85	1,120
2.20	65	4.10	264	6.00	580	7.90	1,140
2.25	69	4.15	271	6.05	591	7.95	1,160
2.30	72	4.20	278	6.10	602	8.00	1,180
2.35	76	4.25	285	6.15	613	8.05	1,210
2.40	80	4.30	292	6.20	624	8.10	1,240
2.45	84	4.35	299	6.25	635	8.15	1,260
2.50	88	4.40	306	6.30	646	8.20	1,290
2.55	92	4.45	313	6.35	657	8.25	1,320
2.60	98	4.50	320	6.40	668	8.30	1,340
2.65	102	4.55	328	6.45	679	8.35	1,370
2.70	107	4.60	336	6.50	690	8.40	1,400
2.75	112	4.65	344	6.55	704	8.45	1,420
2.80	116	4.70	352	6.60	717	8.50	1,450
2.85	122	4.75	360	6.65	730	8.55	1,480
2.90	126	4.80	368	6.70	744	8.60	1,520
2.95	131	4.85	376	6.75	758	8.65	1,550
3.00	136	4.90	384	6.80	771	8.70	1,590
3.05	141	4.95	392	6.85	784	8.75	1,620
3.10	146	5.00	400	6.90	798	8.80	1,650
3.15	152	5.05	408	6.95	812	8.85	1,690
3.20	158	5.10	417	7.00	825	8.90	1,720
3.25	163	5.15	426	7.05	840	8.95	1,760
3.30	168	5.20	434	7.10	856	9.00	1,790
3.35	174	5.25	442	7.15	872	9.05	1,830

[a] Correction necessary during frozen periods.

Rating table for Red Cedar River at Agricultural College, Mich., from August 31, 1902, to December 31, 1903—Continued.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
9.10	1,870	9.40	2,110	9.70	2,374	10.00	2,650
9.15	1,910	9.45	2,150	9.75	2,420	10.05	2,700
9.20	1,950	9.50	2,190	9.80	2,470	10.10	2,750
9.25	1,990	9.55	2,240	9.85	2,510		
9.30	2,030	9.60	2,280	9.90	2,560		
9.35	2,070	9.65	2,330	9.95	2,600		

Mean daily discharge, in second-feet, of Red Cedar River at Agricultural College, Mich., for 1902. [a]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	29	717	152	179	18	.....	40	179	336	214
2	.....	32	646	146	168	19	.....	50	179	328	214
3	.....	43	514	146	278	20	.....	36	190	278	226
4	.....	50	417	141	451	21	.....	29	174	250	338
5	.....	46	336	136	417	22	.....	18	168	226	657
6	.....	36	451	264	328	23	.....	58	158	214	744
7	.....	43	561	384	264	24	.....	112	146	190	613
8	.....	36	485	352	238	25	.....	306	146	174	613
9	.....	40	408	292	238	26	.....	451	146	168	624
10	.....	36	328	257	226	27	.....	442	184	158	431
11	.....	50	264	226	202	28	.....	561	220	158	395
12	.....	50	226	214	190	29	.....	771	202	168	329
13	.....	58	226	(b)	238	30	.....	812	179	174	292
14	.....	15	214	(b)	190	31	22	.....	168	.....	219
15	.....	29	208	214	158						
16	.....	26	202	226	168	Mean	.....	141	285	223	322
17	.....	29	190	264	202						

[a] December 27 to December 31, stream frozen; discharge approximate. [b] No record.

Mean daily discharge, in second-feet, of Red Cedar River at Agricultural College, Mich., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	209	1,550	1,700	214	214	72	116	80	856	158	102	116
2	184	1,320	1,670	226	202	80	184	80	771	158	88	126
3	209	1,140	1,630	299	196	76	285	80	624	158	107	112
4	286	980	1,600	434	271	76	214	107	476	168	107	107
5	347	798	1,420	552	244	72	168	179	360	190	102	102
6	335	668	1,370	717	214	69	131	226	264	168	98	107
7	305	591	1,790	980	190	69	116	190	214	196	98	88
8	263	451	2,110	784	174	61	102	158	190	320	107	112
9	204	392	2,070	561	163	72	92	126	184	384	88	107
10	204	400	1,760	434	146	76	84	98	174	320	98	107
11	194	468	1,690	408	126	84	80	107	168	264	98	102
12	179	657	1,590	1,040	116	76	76	88	158	232	158	107
13	166	934	1,260	1,690	112	72	65	80	146	202	232	73
14	162	1,020	1,020	2,240	107	92	65	72	168	190	220	77
15	162	887	784	2,700	102	80	58	50	285	174	196	73
16	153	395	679	2,650	102	80	50	65	624	168	202	87
17	158	341	613	2,240	92	88	43	58	872	168	250	94
18	158	316	561	1,650	84	107	76	65	1,240	158	257	97
19	149	263	504	1,160	98	98	202	65	1,100	152	220	90
20	140	204	476	856	112	126	202	72	825	146	174	90
21	136	199	417	624	92	163	179	46	646	141	190	90
22	136	189	360	476	98	184	202	58	532	126	179	113
23	128	184	320	384	107	376	244	43	417	126	163	113
24	132	179	336	352	146	523	214	80	306	116	168	113
25	125	170	320	417	152	476	168	126	238	107	168	117
26	128	170	306	460	146	400	136	152	202	107	168	113
27	196	214	292	400	146	320	116	174	190	116	146	113
28	336	905	306	336	152	232	107	384	202	112	131	105
29	1,060	.....	278	278	122	174	116	602	179	107	131	113
30	1,910	.....	257	226	102	136	107	771	163	112	107	117
31	1,990	.....	232	.....	92	.....	88	856	.....	107	.....	113
Mean	337	571	959	860	143	154	132	172	423	173	152	103

[a] Stream frozen, discharge approximate, January 1 to 26, inclusive; February 16 to March 6, inclusive; December 13 to 31, inclusive.

Estimated monthly discharge of Red Cedar River at Agricultural College, Mich., for 1902 and 1903.

[Drainage area, 358 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902					
September	812	15	144	0.40	0.45
October	717	146	285	.80	.92
November	384	136	223	.62	.69
December	744	158	322	.90	1.04
1903.					
January	1,990	125	337	.94	1.08
February	1,550	170	571	1.59	1.65
March	2,110	232	959	2.68	3.09
April	2,700	214	860	2.40	2.68
May	271	84	143	.40	.46
June	523	61	154	.43	.48
July	285	43	132	.37	.43
August	856	43	172	.48	.55
September	1,240	146	423	1.18	1.32
October	384	107	173	.48	.55
November	257	88	152	.42	.47
December	126	73	103	.29	.33
The year	2,700	43	348	.97	13.09

KALAMAZOO RIVER NEAR ALLEGAN, MICH.

A gaging station was established at the dam of the Kalamazoo Valley Electric Company, Trowbridge Township, 6 miles upstream by river from Allegan, April 4, 1901. The dam is of timber crib work filled with stone, resting on a pile foundation in clay hardpan. The dam is equipped with three Taintor segmental flood gates, each of 19.7 feet clear width. In the adjacent power house, forming a portion of the dam, are eight 43-inch Leffel-Samson turbines arranged in two sets on a horizontal shaft, each set controlled by a separate governor. The gaging record includes the number of hours of daily run; the average gate opening of the turbines, as indicated by the index wheels of the governors; the stage of water on the tailrace gage; and the reading of the crest gage. The crest gage is set with its zero at the elevation of the horizontal spillways of 20 feet crest width each, which are closed by the Taintor gates. The crest gage also serves to show

the depth flowing over the crests of the Taintor gates or of flashboards placed thereon. A record of the opening and closing of the Taintor gates is also kept. The pond above the dam covers an area of 1,000 acres. The turbines run continuously and the flow of the stream is nearly all utilized, except in times of extreme freshet. At such times the water level is controlled by means of the flood gates described.

The crest and tailrace gages are set with a difference of elevation of 12 feet, and both are referred to the top of the masonry pier at the entrance to the flume as a bench mark. The elevation of the zero of the crest gage is 83.95 feet; that of the zero of the tailrace gage, 71.95 feet.

The effective head varies from 21 to 23 feet. The record is maintained in cooperation with the Kalamazoo Valley Electric Company, the gages having been set under the direction of H. C. Hoagland, superintendent. One power plant of this company contains a 1,500-kilowatt multipolar generator, and the power is used for long-distance transmission to drive interurban electric railroads. Two similar power plants, both above the former, have been erected, at which similar records are maintained.

A measurement of the high-water discharge of North Branch Kalamazoo River at Albion, Mich., March 9, 1903, at the electric railroad bridge, showed the flow to be 232 second-feet, or 1.68 second-feet per square mile from the tributary drainage area of 138 square miles.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

The following discharge measurements are reported by George S. Pierson:

October 6, 1895, river very low. Mean discharge for forty-eight hours over a specially constructed weir on crest of dam at Otsego, 251 second-feet.

July 9, 1901, discharge measurement by floats run through a 20-foot length of cross-section, 652 second-feet; location, four or five miles above gaging station at Trowbridge dam, and just above confluence of Pine Creek.

Discharge measurements of Kalamazoo River were made as follows during 1903 by R. E. Horton:

August 1, 1903: Discharge measured at Camp Ground bridge, near Albion, below junction of two main branches, 174 second-feet.[a]

August 7, 1903: North Branch Kalamazoo River at bridge 2 miles south of Bath Mills, Mich.; discharge, 52 second-feet.[b]

August 8, 1903: South Branch Kalamazoo River, near Condit, Mich.; discharge, 120 second-feet at head of mill pond.

Kalamazoo River drainage basin lies in a morainal district underlain by an artesian basin at considerable depth. The stream receives a considerable supply from springs issuing from a cusp of the terminal

[a] Water surface, 5.61 feet below top of outside bridge chord, near left-hand abutment.

[b] Above mill pond, water surface 3.39 feet below top of floor eye beam; downstream side, left-hand end.

moraine left by a glacier of the later ice epoch. The outflow from a group of springs, known as the Torrey Springs, near Albion, August 9, 1903, was found to be 4.75 second-feet. Camp Ground Spring, 2 miles downstream, yielded in August, 1903, 0.38 second-foot.

Mean daily discharge, in second-feet, of Kalamazoo River near Allegan, Mich., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,035	3,239	3,546	1,475	1,682	950	836	1,285	1,550	1,392	646	1,061
2	962	2,156	3,737	1,477	92	1,002	836	765	1,030	1,342	915	860
3	1,966	2,520	3,740	1,646	1,799	953	836	1,034	1,180	1,240	1,033	1,061
4	1,857	2,476	3,451	1,600	1,377	765	899	998	1,249	1,017	997	985
5	1,444	2,174	3,544	1,982	1,536	765	930	1,636	1,327	1,379	911	1,125
6	1,366	1,860	3,434	1,306	1,168	1,197	846	1,429	1,121	1,039	1,182	922
7	1,142	1,751	3,195	1,895	1,225	1,182	846	1,134	851	1,183	1,171	997
8	1,270	1,791	3,121	1,893	1,388	1,136	900	1,145	1,349	1,125	5	1,095
9	1,822	1,539	3,577	1,765	1,133	1,116	900	1,135	859	1,737	511	858
10	816	1,732	3,344	1,724	1,313	865	826	989	1,247	1,666	745	1,084
11	774	1,713	4,378	2,346	1,004	864	828	1,117	1,174	1,676	765	1,084
12	962	1,906	4,359	2,161	815	865	698	1,352	851	1,285	912	1,174
13	948	2,021	3,717	2,699	1,028	836	899	900	1,311	1,287	1,263	1,021
14	758	1,700	3,458	3,396	1,169	765	899	963	1,467	1,223	1,257	415
15	1,621	1,712	3,065	3,095	1,145	1,065	900	899	1,684	1,124	1,133	438
16	1,497	1,375	2,656	3,798	998	845	816	701	1,125	1,714	1,141	841
17	1,491	1,264	2,931	4,336	676	900	877	975	2,457	1,061	1,226	973
18	1,415	913	2,355	4,374	1,099	900	694	975	1,654	851	1,153	1,535
19	1,147	780	2,549	4,210	815	836	1,007	782	2,680	1,274	1,072	1,246
20	954	589	2,090	3,111	732	915	982	910	1,648	1,243	1,226	1,368
21	1,149	1,045	1,790	2,669	889	765	1,266	899	1,061	1,100	1,226	1,563
22	1,173	1,706	1,867	2,503	1,039	1,297	1,060	845	1,392	924	1,088	1,344
23	1,069	1,427	1,635	2,650	1,170	900	1,054	656	1,274	1,209	1,072	1,392
24	1,033	1,907	1,882	1,761	1,351	1,809	990	709	997	1,988	1,226	1,630
25	642	1,607	1,639	2,416	1,333	1,263	1,044	797	1,593	259	1,088	1,193
26	1,540	1,395	1,345	2,072	1,281	1,489	848	797	1,225	921	931	1,116
27	1,178	1,872	1,410	2,331	1,191	1,190	879	705	1,528	1,037	1,034	818
28	2,434	3,241	1,766	1,853	1,151	884	1,045	1,073	1,509	853	976	872
29	3,809	.....	1,567	1,766	1,091	1,127	836	905	1,245	745	1,103	985
30	1,512	.....	1,309	1,656	1,022	997	990	1,518	1,061	1,047	1,261	1,160
31	1,625	.....	1,241	.....	947	.....	900	1,363	.....	900	.....	988

[a] This table not comparable with preceding years' record given in Water-Supply Paper 83, pp. 269–273, in which only the normal flow is included as available for power, the freshet discharge being there omitted.

Estimated monthly discharge of Kalamazoo River near Allegan, Mich., for 1903.

[Drainage area, 1,471 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	3,809	642	1,368	0.93	1.07
February	3,241	589	1,764	1.20	1.24
March	4,378	1,241	2,700	1.84	2.12
April	4,374	1,306	2,399	1.63	1.82
May	1,799	92	1,118	.76	.87
June	1,809	765	1,014	.69	.77
July	1,266	694	908	.62	.71
August	1,518	705	1,012	.69	.79
September	2,680	851	1,356	.92	1.02
October	1,737	259	1,188	.81	.93
November	1,226	5	1,008	.68	.75
December	1,630	415	1,071	.72	.83
The year	4,378	5	1,409	.96	12.95

ST. JOSEPH RIVER AT BUCHANAN, MICH.

A gaging station was established on St. Joseph River at the dam of the Buchanan Electric Light and Power Company, 1 mile below the village of Buchanan, April 1, 1901. The dam is of frame timber of the Beardsley type, 10 feet high, and rests on earth foundation, leakage being prevented by means of triple sheet piling at the downstream toe. The upstream face of the dam has a slope of approximately 2.4 horizontal to 1 vertical. The downstream side is also faced with a sloping apron, the two slopes meeting at the crest at an angle of 90°. The dam is level and 392.5 feet in length. The crest gage is attached to piling 45 feet upstream from the crest, and is read at 7.30 a. m. and 5.30 p. m. each day by Charles E. Babcock.

At the right-hand side of the stream is situated the Buchanan electric light plant, containing three special 48-inch New American turbines, 1895 model. These are controlled by a single Woodward governor, and a record is kept of the number of hours per day the wheels are run and the average opening of the speed gate.

On the left-hand side of the dam are two 35-inch Leffel turbines in separate vertical-cylinder cases connected to a single governor; from them power is transmitted to adjacent mills by manila rope. A record is also kept of the daily operation of these turbines by Charles E. Kissenger. The average working head on the water wheels is 11.25 feet.

A small amount of leakage through the dam existed in 1901, which was repaired during 1903, an estimate of the leakage was obtained, and a new profile taken.

These data, together with the later weir coefficients, obtained from the United States Geological Survey experiments at Cornell University, will enable the discharge for preceding years to be recalculated, and the results will probably be increased somewhat.

The record at Buchanan is kept through the cooperation of Hugh H. Hosford, superintendent of the electric light and power plant.

FAWN RIVER NEAR WHITE PIGEON, MICH.

Fawn River is a tributary of St. Joseph River, rising in northern Indiana, near the Michigan line, flowing generally westward, crossing and recrossing from Michigan to Indiana and entering St. Joseph River at Constantine. The drainage basin is flat with soil of sand and loam, and contains numerous lakes and undrained ponds, Klinger and Pickerel lakes being the largest and having water-surface areas of about 1 square mile each.

A gage was erected at the highway bridge below the abandoned Kidd mill dam, 4 miles from White Pigeon, July 4, 1903. The stream stage has been observed twice daily, by William Probst, on a vertical graduated scale attached to the downstream left side of the bridge. Discharge measurements have been made from a boat at a point 500 feet downstream from the gage.

In the winter the stream freezes over at and below the gage, thereby changing the relation between the stage or discharge of the stream, as compared with open periods.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Fawn River near White Pigeon, Mich., in 1903.[a]

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
Spring	C. G. Wentmore	[b] 3.60	533
July 4	W. M. Gregory	[b] 1.70	102
August 5	R. E. Horton	1.99	145

[a] Stream measured from boat by current meter in smooth channel section below bridge.
[b] Approximate.

Mean daily gage height, in feet, of Fawn River near White Pigeon, Mich., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.70	2.40	1.90	1.70	1.70	17	1.60	1.80	2.90	1.85	1.70	1.95
2	.....	1.70	2.35	1.90	1.75	1.70	18	1.85	1.80	2.90	1.80	1.80	1.90
3	.....	1.70	2.15	1.80	1.70	1.60	19	1.85	1.80	2.90	1.80	1.70	1.90
4	.....	1.85	2.05	1.85	1.70	1.65	20	1.80	1.80	2.90	1.80	1.70	1.90
5	1.65	1.90	1.95	1.80	1.70	1.55	21	1.85	1.70	2.80	1.75	1.70	1.90
6	1.60	1.90	1.90	1.90	1.80	1.70	22	1.85	1.70	2.40	1.75	1.70	1.90
7	1.55	1.90	1.90	1.90	1.70	1.80	23	1.90	1.70	2.10	1.80	1.70	1.85
8	1.50	1.90	1.85	2.00	1.70	1.75	24	1.80	1.70	2.10	1.75	1.70	1.80
9	1.50	1.90	1.85	1.90	1.70	1.70	25	1.80	1.70	1.95	1.70	1.70	1.80
10	1.60	1.85	1.80	.....	1.70	1.70	26	1.70	1.70	1.85	1.75	1.70	1.80
11	1.60	1.80	1.80	1.90	1.70	1.45	27	1.70	1.95	1.85	1.70	1.75	1.70
12	1.60	1.80	1.80	1.80	1.80	1.55	28	1.70	2.05	1.90	1.70	1.80	1.70
13	1.60	1.75	1.90	1.80	1.80	1.70	29	1.70	2.10	1.90	1.70	1.80	1.80
14	1.60	1.80	2.05	1.80	1.75	1.60	30	1.80	2.05	1.90	1.70	1.70	1.80
15	1.60	1.80	2.10	1.80	1.70	1.55	31	1.75	2.30	.....	1.70	.....	1.80
16	1.60	1.80	2.20	1.90	1.70	1.95							

ST. JOSEPH RIVER AT MENDON, MICH.

This station was established October 25, 1902. It is located at the Marantette highway bridge, near Mendon, Mich. The bridge has a single span of 136.5 feet between abutments, stands squarely across the direction of the current, and affords a fairly permanent cross section for gaging, the bed being of smooth clay. There is a bend in the stream a short distance above the bridge, but the channel below for some distance is straight. It is broken by an old bridge pier in the center, which causes eddying and some dead water. Little Portage River flows parallel to and about 1 mile distant from St. Joseph River at Mendon, and was at one time diverted across the divide, affording water power with a fall of 20 feet, but this has been discontinued. The drainage area above Marantette Bridge is 844 square miles. The gage is a vertical board attached to a cedar post near the water's edge in the village, about half a mile above the station. It is read twice each day by William P. McCoy. Little Portage River enters the St. Joseph between the gage and the measuring section and complicates the problem somewhat. The bench mark is the top of the head of a spike driven into the brick wall at the southeast corner of Masonic Hall building, 150 feet northwest from the gage. Its elevation is 19.95 feet above the zero of the gage. The growth of aquatic plants in the channel changes the relation of gage height to discharge during the summer.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of St. Joseph River at Mendon, Mich., in 1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
March 20	Horton and Roundey	3.00	2,396
May 11	W. M. Gregory	1.62	949
July 3	do	1.80	530
July 6	do	1.70	467
August 4	Horton and Murphy	2.00	436
August 31	W. M. Gregory	2.50	777

[a] Discharge measured at Marantette bridge gage at Mendon post-office. Portage Creek enters between bridge and gage.

Mean daily gage height, in feet, of St. Joseph River at Mendon, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.20	3.58	3.50	1.82	2.35	1.50	1.70	2.00	2.50	1.70	1.18	1.20
2	4.00	3.60	3.70	1.80	2.15	1.50	1.70	2.00	2.50	1.70	1.15	1.20
3	2.70	3.62	3.88	1.92	2.08	1.50	1.80	2.00	2.42	1.60	1.10	1.20
4	2.50	3.85	3.90	2.35	2.00	1.50	1.78	2.00	2.40	1.60	1.10	1.25
5	2.20	4.02	3.98	2.65	1.90	1.50	1.70	2.02	2.35	1.60	1.10	1.25
6	2.20	4.10	4.00	2.70	1.90	1.50	1.70	2.15	2.30	1.60	1.10	1.30
7	2.18	4.40	4.45	2.80	1.90	1.50	1.70	2.20	2.20	1.70	1.10	1.32
8	2.50	4.45	4.65	2.75	1.80	1.52	1.70	2.25	2.10	1.75	1.10	1.40
9	4.80	4.85	5.00	2.65	1.80	1.60	1.72	2.30	2.08	1.80	1.10	1.40
10	4.45	2.85	4.90	2.58	1.68	1.60	1.80	2.28	2.00	1.80	1.10	1.40
11	4.40	2.32	4.72	2.58	1.62	1.55	1.80	2.20	2.00	1.80	1.10	1.40
12	4.50	2.30	4.30	2.85	1.58	1.50	1.80	2.15	1.90	1.78	1.20	1.40
13	4.45	2.20	4.10	3.60	1.50	1.50	1.72	2.05	1.88	1.75	1.20	1.40
14	4.32	2.18	3.85	4.90	1.50	1.50	1.65	2.00	2.02	1.75	1.20	1.40
15	4.25	2.15	4.40	5.45	1.45	1.48	1.60	2.00	2.10	1.75	1.20	1.40
16	3.90	2.20	3.30	5.65	1.40	1.40	1.60	1.90	2.10	1.75	1.20	1.40
17	3.80	2.20	3.25	5.55	1.40	1.40	1.60	1.90	2.20	1.70	1.30	1.40
18	3.80	2.22	3.10	5.15	1.38	1.40	1.92	1.80	2.22	1.65	1.30	1.40
19	3.45	2.25	3.08	4.80	1.35	1.38	2.05	1.80	2.28	1.60	1.25	1.40
20	3.30	2.25	2.95	4.50	1.32	1.30	2.10	1.80	2.35	1.50	1.22	1.60
21	2.75	2.28	2.85	4.00	1.30	1.30	2.25	1.75	2.30	1.50	1.20	1.60
22	2.60	2.30	2.75	3.60	1.30	1.55	2.20	1.70	2.30	1.35	1.20	1.60
23	2.35	2.30	2.65	3.15	1.38	1.85	2.20	1.70	2.25	1.30	1.20	1.70
24	2.30	2.65	2.55	3.05	1.40	1.98	2.20	1.70	2.20	1.30	1.20	1.70
25	2.22	3.00	2.35	3.00	1.40	2.00	2.15	1.70	2.15	1.30	1.20	1.65
26	2.20	3.00	2.30	2.95	1.48	2.00	2.08	1.70	2.00	1.25	1.20	1.60
27	2.20	3.12	2.20	2.75	1.50	1.92	2.02	2.05	2.00	1.20	1.20	1.60
28	2.12	3.20	2.08	2.55	1.50	1.90	2.00	2.20	2.00	1.20	1.20	1.60
29	2.15	.....	2.02	2.50	1.50	1.80	2.00	2.30	2.00	1.20	1.20	1.60
30	2.75	.....	1.95	2.48	1.50	1.80	2.00	2.40	1.90	1.20	1.20	1.60
31	3.45	.....	1.87	.....	1.50	.....	2.00	2.50	.....	1.20	.....	1.60

FOX RIVER AT OMRO, WIS.

This station was established November 22, 1902, by L. R. Stockman. It is located at the city highway bridge at Omro, Wis., about 2,500 feet from the Chicago, Milwaukee and St. Paul Railway station. The gage is a vertical board fastened to a pile in the protection to the center pier. It is read twice each day by William Herner. Discharge measurements are made from the five-span highway bridge, which has a total length of 350 feet between abutments. The initial point for soundings is a nail in the footboard at a point directly over the right abutment and opposite the end post of the hand rail. The channel is straight for 1,000 feet above and below the station, and at ordinary stages practically all of the water flows beneath two spans of the bridge. The bed is of soft material and is thickly overgrown with water plants, except in the navigable channel. There is no velocity except in the navigable channel, and even here the stream becomes sluggish at low stages. The right bank is high, and the left bank is low, but neither is subject to overflow. Bench mark No. 1 is on the water table at the southwest corner of Robinson's store. Its elevation is 17.24 feet above the zero of the gage. Bench mark No. 2 is a cross on the south abutment, on the upstream side. Its elevation is 8.97 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Fox River at Omro, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 6 [a]	L. R. Stockman	4.70	625
January 26 [a]	do	4.50	536
February 21 [a]	do	4.20	549
March 25	do	6.60	2,984
April 15	do	6.20	1,450
May 11	do	5.70	625
June 4	do	6.05	1,050
June 20	do	5.50	691

[a] River frozen.

Mean daily gage height, in feet, of Fox River at Omro, Wis., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Nov.	Dec.
1902.									
1									4.50
2									4.65
3									4.60
4									4.65
5									4.65
6									4.70
7									4.70
8									4.50
9									4.50
10									4.50
11									4.50
12									4.50
13									4.50
14									4.50
15									4.50
16									4.55
17									4.50
18									4.55
19									4.55
20									4.65
21									4.70
22								4.60	4.80
23								4.60	4.80
24								4.70	4.80
25								4.70	4.80
26								4.75	4.70
27								4.60	4.70
28								4.50	4.70
29								4.60	4.75
30								4.50	4.80
31									4.80

Mean daily gage height, in feet, of Fox River at Omro, Wis., for 1902 and 1903—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Nov.	Dec.
1903.									
1	4.70	4.40	4.90	6.40	5.70	6.30	5.30	.....	.....
2	4.75	4.40	4.75	6.55	5.70	6.25	5.30	.....	.....
3	4.70	4.40	4.70	6.60	5.70	6.15	5.20	.....	.....
4	4.70	4.50	4.70	6.40	5.70	6.10	5.20	.....	.....
5	4.70	4.45	4.80	6.40	5.70	6.00	5.20	.....	.....
6	4.70	4.40	4.90	6.40	5.65	6.00	5.20	.....	.....
7	4.70	4.40	5.20	6.30	5.60	6.00	5.20	.....	.....
8	4.70	4.40	5.35	6.20	5.55	6.00	5.20	.....	.....
9	4.75	4.40	5.55	6.20	5.50	6.00	5.30	.....	.....
10	4.55	4.45	5.75	6.20	5.55	6.00	5.30	.....	.....
11	4.60	4.50	6.00	6.30	5.65	6.00	5.40	.....	.....
12	4.60	4.50	6.55	6.30	5.60	6.00	5.30	.....	.....
13	4.60	4.45	6.75	6.40	5.60	5.90	5.30	.....	.....
14	4.60	4.50	6.05	6.40	5.85	5.90	5.30	.....	.....
15	4.55	4.50	5.85	6.20	5.80	5.75	5.30	.....	.....
16	4.60	4.50	5.70	6.20	5.60	5.80	5.20	.....	.....
17	4.50	4.40	5.75	6.10	5.60	5.70	5.20	.....	.....
18	4.50	4.30	5.70	6.10	5.70	5.60	5.10	.....	.....
19	4.50	4.30	6.20	6.00	5.60	5.60	5.10	.....	.....
20	4.50	4.30	6.30	6.00	5.60	5.60	5.10	.....	.....
21	4.50	4.20	6.30	5.90	5.80	5.70	5.10	.....	.....
22	4.50	4.20	6.35	5.90	5.80	6.65	5.10	.....	.....
23	4.50	4.20	6.45	5.90	5.85	5.60	5.00	.....	.....
24	4.45	4.20	6.50	5.90	5.85	5.50	5.00	.....	.....
25	4.40	4.20	6.50	5.90	5.90	5.50	5.00	.....	.....
26	4.40	4.20	6.50	5.95	6.05	5.40	.....	.....	.....
27	4.50	4.60	6.50	5.90	6.20	5.40	.....	.....	.....
28	4.50	5.10	6.10	5.90	6.25	5.40	.....	.....	.....
29	4.50	.....	6.60	5.80	6.30	5.40	.....	.....	.....
30	4.50	.....	6.60	5.80	6.25	5.40	.....	.....	.....
31	4.50	.....	6.40	.....	6.20	.....	.....	.....	.....

FOX RIVER AT WRIGHTSTOWN, WIS.

This station was established November 19, 1902, by L. R. Stockman. It is located at the highway bridge, about 2,000 feet from the Chicago and Northwestern Railway station. A small tributary enters just above the bridge on the right side. There are no dams nearer than Kaukauna, which is 6 miles up the river. There is a small island just above the bridge, near the right bank. The gage is a vertical board fastened to a pile in the protection to the central pier; it is read twice each day by Peter Van Lieshout. Discharge measurements are made from the upper side of the six-span highway bridge, to which the gage is attached. The initial point for soundings is a nail in the railing at the left end of the bridge. The channel is straight for 2,500 feet above and below the station. At the bridge the channel is 460 feet wide, broken by five piers. The right bank is low; the left bank is high, both being covered with grass to the water's edge. The entire

flow passes beneath the bridge at all stages. The bed of the stream is of clay and loam, is without vegetation, and is permanent. The current velocity is moderate and well distributed. Bench mark No. 1 is a projecting stone in the northwest corner of the foundation of the American House at a point two-tenths of a foot above the sidewalk and 2 feet from the corner of the foundation. This building is located on the street that crosses the bridge. The elevation of the bench mark is 20.21 feet above the zero of the gage. Bench mark No. 2 is a cross in a limestone rock in the east end of the south bridge abutment. Its elevation above the zero of the gage is 12.46 feet. On the vertical face of this abutment is an arrow pointing upward to the bench mark.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Fox River at Wrightstown, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 2	L. R. Stockman	6.40	[a] 3,176
January 22	do	6.80	[a] 4,137
February 19	do	7.00	[a] 4,214
March 23	do	4.70	2,118
April 13	do	7.45	7,939
April 16	do	6.90	6,319
May 9	do	6.90	6,513
June 3	do	6.90	6,298
June 19	do	6.80	5,941
July 22	E. C. Murphy	6.85	5,194
July 29	L. R. Stockman	6.60	4,743
October 28	do	7.08	5,988

[a] River frozen.

Mean daily gage height, in feet, of Fox River at Wrightstown, Wis., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1												6.45
2												6.45
3												6.50
4												6.55
5												6.50
6												6.55
7												5.35
8												5.75
9												6.40
10												6.45
11												6.60
12												6.50
13												5.60
14												5.70
15												5.50
16												6.55
17												6.45
18												6.40
19											6.40	6.40
20											6.45	6.45
21											6.45	5.70
22											6.45	5.45
23											6.45	6.35
24											6.05	6.30
25											6.45	5.60
26											6.55	5.50
27											6.50	6.35
28											6.45	
29											6.50	
30											5.30	
31												

Mean daily gage height, in feet, of Fox River at Wrightstown, Wis., for 1902 and 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	6.40	6.15	6.15	6.85	6.80	6.65	6.85	6.60	6.80	7.25	5.95	6.20
2	6.40	5.75	5.80	7.15	7.00	6.40	6.75	6.60	6.90	7.20	5.60	6.30
3	6.35	6.75	6.80	7.25	5.70	7.40	6.80	5.15	7.00	7.20	6.75	6.30
4	5.65	6.60	6.85	7.75	6.05	7.50	6.00	6.50	7.00	6.35	6.90	6.55
5	5.15	6.75	7.00	7.95	6.90	6.70	5.30	6.65	6.90	6.10	6.90	6.60
6	6.40	6.80	6.80	7.60	7.00	6.70	5.40	6.55	6.10	7.20	6.90	5.65
7	6.60	6.85	6.95	7.65	6.55	6.75	6.10	6.55	5.20	7.45	6.90	5.55
8	6.60	6.12	6.40	7.00	7.05	5.90	6.10	6.50	6.60	7.25	5.80	6.45
9	6.50	5.70	5.95	6.95	6.95	5.55	6.20	5.70	7.10	7.15	5.45	6.50
10	6.10	6.87	6.90	7.05	5.65	6.95	6.00	5.70	7.20	7.20	6.60	6.60
11	6.30	7.05	7.00	7.75	5.85	7.00	6.00	6.80	7.30	6.20	6.85	6.50
12	5.50	7.10	6.95	7.65	6.70	7.00	5.50	6.60	7.20	5.95	6.85	6.50
13	6.50	7.00	7.05	7.40	6.75	6.90	5.90	6.60	6.50	7.05	6.85	5.50
14	6.50	7.05	7.00	7.85	6.70	5.80	6.85	6.90	6.20	7.20	6.80	5.45
15	6.75	6.45	6.35	7.75	6.70	5.75	6.80	6.90	7.30	7.20	5.70	6.40
16	6.90	5.95	5.90	7.15	6.70	6.80	6.85	5.90	7.40	7.20	5.35	6.80
17	7.00	6.80	7.10	7.15	6.80	6.75	6.90	5.70	7.40	7.20	6.65	6.85
18	5.50	6.85	7.20	6.95	5.90	6.80	7.00	6.70	7.40	6.85	6.70	6.60
19	5.70	6.98	8.65	5.95	6.85	6.70	6.00	6.90	7.50	5.80	7.35	6.60
20	6.80	7.00	7.60	6.10	7.00	6.70	5.80	6.90	6.70	7.35	6.75	5.80
21	6.90	7.05	6.00	6.85	6.90	5.35	6.80	6.80	6.30	7.05	6.80	6.00
22	6.85	6.35	4.90	6.75	6.90	5.60	6.90	6.80	7.30	7.17	5.80	6.40
23	6.90	5.95	4.90	6.85	7.00	5.60	6.90	5.90	7.40	7.05	5.60	6.60
24	6.90	6.80	6.15	6.75	5.50	6.70	6.90	5.60	7.30	7.05	6.85	6.60
25	5.80	6.80	6.40	6.60	6.35	6.80	6.70	6.80	7.40	6.10	7.10	5.60
26	5.70	6.80	6.45	5.90	7.10	6.75	5.80	6.90	7.40	5.80	6.75	5.00
27	6.85	7.07	6.35	5.90	7.50	6.65	5.40	6.90	6.30	6.95	6.25	3.80
28	6.90	7.20	6.55	6.85	7.25	5.70	6.50	6.90	6.05	7.10	6.20	4.20
29	6.95	.....	6.05	7.00	7.20	5.55	6.60	7.00	7.30	7.10	5.90	5.20
30	6.85	.....	5.60	6.90	7.20	6.80	6.60	5.90	7.35	7.10	5.90	5.40
31	6.85	.....	6.65	.....	.....	.....	6.60	5.40	.....	7.00	.....	5.40

WOLF RIVER AT WINNECONNE, WIS.

This station was established November 24, 1902, by L. R. Stockman. It is located at the highway bridge at Winneconne, Wis., about 1,000 feet from the Chicago, Milwaukee and St. Paul Railway station, and is one-half mile below the mouth of Lake Poygan, which is drained by Wolf River. The flow at this point is influenced by the direction of the wind and by the lake. For this reason it was discontinued July 30, 1903. The gage is a vertical board fastened to a pile at the lower end of the protection to the central pier of the drawbridge. Readings have been made twice each day by C. P. O'Toole, the bridge tender. Discharge measurements are made from the eight-span highway bridge, to which the gage is attached. The channel is 600 feet wide between the bridge abutments, and is straight both above and below the station. The section is deep and the flow is sluggish. The right bank is high and the left bank is low, but the water is confined between the bridge abutments at all stages. The bed of the stream is composed of silt. The bench mark is on the water table at the extreme northeast corner of the Union Bank Building. Its elevation is 12.81 feet above the zero of the gage. The initial point for soundings is a point marked by three nails and an arrow at the left end of the bridge, directly over the abutment.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Wolf River at Winneconne, Wis.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 5 [a]	L. R. Stockman	5.50	904
January 24 [a]	do	5.30	1,436
February 20	do	5.00	1,285
March 24	do	6.60	9,998
April 15	do	6.90	3,808
May 11	do	6.70	3,537
June 20	do	6.40	3,194

[a] River frozen.

Mean daily gage height, in feet, of Wolf River at Winneconne, Wis., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Nov.	Dec.
1902.									
1									5.50
2									5.50
3									5.50
4									5.50
5									5.50
6									5.50
7									5.50
8									5.50
9									5.50
10									5.50
11									5.40
12									5.40
13									5.40
14									5.40
15									5.40
16									5.40
17									5.40
18									5.40
19									5.40
20									5.40
21									5.50
22									5.50
23									5.50
24								5.55	5.50
25								5.60	5.50
26								5.55	5.50
27								5.50	5.50
28								5.50	5.50
29								5.60	5.50
30								5.50	5.50
31									5.50

Mean daily gage height, in feet, of Wolf River at Winneconne, Wis., for 1902 and 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Nov.	Dec.
1903.									
1	5.50	5.30	4.80	7.10	6.60	7.00	6.10	.....	.....
2	5.50	5.30	4.80	7.20	6.65	7.00	6.10	.....	.....
3	5.50	5.30	4.80	7.20	6.70	7.00	6.10	.....	.....
4	5.50	5.20	4.80	7.10	6.65	6.90	6.10	.....	.....
5	5.50	5.20	4.80	7.10	6.60	6.80	6.10	.....	.....
6	5.50	5.20	4.90	7.10	6.65	6.80	6.10	.....	.....
7	5.50	5.20	4.90	7.05	6.70	6.85	6.20	.....	.....
8	5.50	5.20	4.90	6.90	6.70	6.80	6.20	.....	.....
9	5.50	5.20	4.90	6.80	6.70	6.80	6.20	.....	.....
10	5.50	5.10	5.00	6.95	6.70	6.80	6.30	.....	.....
11	5.50	5.10	5.00	7.10	6.80	6.70	6.30	.....	.....
12	5.50	5.10	5.10	7.00	6.80	6.70	6.30	.....	.....
13	5.50	5.10	5.25	7.00	6.80	6.60	6.30	.....	.....
14	5.50	5.10	5.30	6.90	6.80	6.60	6.30	.....	.....
15	5.50	5.00	5.60	6.80	6.80	6.60	6.30	.....	.....
16	5.50	5.00	5.70	6.85	6.80	6.50	6.30	.....	.....
17	5.50	5.00	5.80	6.90	6.80	6.50	6.30	.....	.....
18	5.40	5.00	5.90	6.80	6.80	6.45	6.40	.....	.....
19	5.40	5.00	6.00	6.80	6.80	6.45	6.40	.....	.....
20	5.40	5.00	6.20	6.75	6.80	6.40	6.40	.....	.....
21	5.40	4.90	6.30	6.70	6.80	6.40	6.30	.....	.....
22	5.40	4.90	6.40	6.80	6.80	6.40	6.30	.....	.....
23	5.40	4.90	6.50	6.80	6.80	6.30	6.20	.....	.....
24	5.40	4.90	6.60	6.80	6.85	6.30	6.20	.....	.....
25	5.40	4.90	6.70	6.80	6.90	6.20	6.10	.....	.....
26	5.40	4.80	6.80	6.80	6.90	6.20	.....	.....	.....
27	5.30	4.80	6.90	6.70	7.05	6.10	.....	.....	.....
28	5.30	4.80	6.90	6.70	6.90	6.10	.....	.....	.....
29	5.30	.....	6.90	6.65	7.00	6.10	.....	.....	.....
30	5.30	.....	7.00	6.60	7.00	6.10	.....	.....	.....
31	5.30	.....	7.10	.....	7.00	.....	.....	.....	.....

FOND DU LAC RIVER (EAST BRANCH), AT FOND DU LAC, WIS.

This station was established in May, 1903, by E. Johnson, jr., assisted by L. R. Stockman, and it was discontinued July 30, 1903. It was located at Division street highway bridge, four blocks from the Chicago and Northwestern Railway station. The gage was a vertical board fastened to the left abutment of the bridge. Readings were taken twice each day by P. Roos. Discharge measurements were made from the single-span highway bridge, to which the gage was attached. The initial point for soundings was the inside of the end post of the hand rail at the left end of the bridge on the upstream side. The channel is straight and has a width of 50 feet. The bed of the stream is soft and overgrown with weeds, and the current is greatly influenced by the wind. Both banks are high and never overflow. The bench mark was the water table at the southeast corner of Macy and

Division streets. Its elevation was 11 feet above the zero of the gage and 11.34 feet above the city datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of East Branch Fond du Lac River at Fond du Lac, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 17	L. R. Stockman		61
May 12	do	1.2	37

Mean daily gage height, in feet, of East Branch Fond du Lac River at Fond du Lac, Wis., for 1903.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1		1.55	1.00	12		1.20	.80	23	.90	1.00	1.00
2		1.40	.95	13		1.20	.85	24	1.25	.95	.90
3		1.30	.80	14		1.20	.90	25	1.35	.90	.80
4		1.30	.80	15		1.25	1.00	26	1.70	.80	
5		1.30	.80	16		1.45	1.05	27	1.70	.80	
6		1.30	.80	17		1.20	.80	28	1.85	.80	
7		1.30	.80	18		1.05	.90	29	1.65	.80	
8		1.35	.80	19		1.15	1.00	30	1.70	.70	
9		1.30	.80	20	1.10	1.00	1.00	31	1.50		
10		1.25	.80	21	1.35	.95	.90				
11		1.35	.80	22	1.15	.90	1.00				

FOND DU LAC RIVER (WEST BRANCH) AT FOND DU LAC, WIS.

This station was established in May, 1903, by E. Johnson, jr., assisted by L. R. Stockman, and was discontinued July 30, 1903. It was located at the Grove Street Bridge, 6 blocks from the Chicago and Northwestern Railway station. There are small rapids just above and an old dam site 3 blocks above the station. The gage was a vertical board on a pile of the Chicago, Milwaukee and St. Paul Railroad bridge 150 feet below the station. Readings were taken twice each day by Peter Thomas. Discharge measurements were made from the single-span highway bridge. The initial point for soundings was a zero mark on the sidewalk over the face of the right abutment. The channel is straight for 150 feet above and below the station. The current is swift, and there is but one channel at all stages. Both banks are high. The bed of the stream is composed of gravel and sand with some rocks. The bench mark was a hydrant at the corner of Grove and Hickory streets. Its elevation was 22.31 feet above the zero of the gage and 23.97 feet above city datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of West Branch of Fond du Lac River at Fond du Lac, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 17	L. R. Stockman	1.7	72
May 12	do	1.2	29
June 5	do	1.55	32

Mean daily gage height, in feet, of West Branch of Fond du Lac River at Fond du Lac, Wis., for 1903.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1		21.50	13.70	12		16.20	13.20	23	12.25	15.80	13.00
2		19.30	13.60	13		16.00	13.20	24	13.00	16.20	13.00
3		18.65	13.30	14		16.00	13.10	25	14.00	16.30	12.90
4		18.25	13.10	15		15.80	13.00	26	15.85	15.90	12.70
5		17.95	13.10	16		15.65	12.90	27	28.55	14.50	12.60
6		17.55	13.10	17		15.55	12.80	28	25.95	14.20	12.40
7		17.10	13.00	18		14.00	13.00	29	23.50	14.00	12.10
8		17.10	12.90	19		14.25	13.00	30	23.50	14.00	11.90
9		17.00	12.80	20	11.50	14.60	13.10	31	21.85		11.60
10		17.00	13.30	21	11.60	15.00	13.10				
11		16.50	13.40	22	11.70	15.10	13.50				

MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

Menominee River forms part of the boundary between Wisconsin and the upper peninsula of Michigan. It is formed by the junction of Brule and Michigamme rivers in T. 41 N., R. 30 W, and flows in a general southeasterly direction, entering Lake Michigan through Green Bay. The station was established September 4, 1902. It is located at the Homestead highway bridge, 2½ miles south of Iron Mountain, Mich. The gage is a vertical board fastened to the right abutment; it is read twice each day by Theodore Moll. Discharge measurements are made from the single-span bridge to which the gage is attached. The channel is straight and has a width of 220 feet between bridge abutments. The current is moderate. The bed of the stream is composed of gravel and small bowlders. The bench mark is the top of the 12-inch timber bridge seat on the right abutment over the gage. Its elevation is 22.68 feet above the zero of the gage. During the winter the stream freezes beneath the bridge and it is difficult to obtain measurements in the frozen section. The relation of gage height to discharge is not the same in the open and frozen sections.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Menominee River near Iron Mountain, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 9	L. R. Stockman	5.40	3,409
April 19	do	7.32	[a] 5,570
July 22	do	4.20	3,161
August 25	do	3.60	2,357
September 16	do	10.38	9,490
October 27	do	3.99	2,856

[a] Variable stage.

Mean daily gage height, in feet, of Menominee River near Iron Mountain, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.55	2.35	2.38	4.68	7.95	9.30	3.70	6.25	4.45	4.30	3.80	3.60
2	2.52	2.30	2.38	5.15	7.85	8.05	4.80	6.20	4.05	4.40	3.80	3.65
3	2.42	2.20	2.42	5.65	9.55	6.30	6.50	4.55	3.70	5.20	3.75	3.55
4	2.48	2.15	2.40	6.35	8.80	7.60	3.85	5.60	3.50	6.60	4.10	3.55
5	2.50	2.15	2.35	2.25	9.45	7.05	3.50	6.60	3.65	7.70	4.00	3.70
6	2.30	2.28	2.48	4.75	9.48	6.50	7.40	8.00	4.00	7.50	3.80	3.60
7	2.25	2.25	2.55	8.30	9.72	3.40	6.30	9.00	4.65	7.65	3.50	3.40
8	2.40	2.22	2.68	5.50	9.60	4.85	5.95	8.90	5.70	7.55	3.65	3.35
9	2.35	2.20	2.72	5.50	9.32	4.85	5.45	7.20	6.65	7.10	3.50	3.35
10	2.30	2.28	2.72	6.05	7.90	4.45	5.25	6.70	6.90	6.85	3.40	3.05
11	2.35	2.40	2.75	6.25	8.98	3.90	5.20	6.75	5.80	6.70	4.10	2.90
12	2.30	2.28	3.00	7.25	8.10	3.50	6.00	6.60	5.50	6.50	4.95	2.60
13	2.20	2.22	3.32	7.15	9.90	4.40	4.65	6.50	7.60	6.25	3.50	2.50
14	2.10	2.25	3.55	6.70	9.45	6.75	4.60	5.40	8.10	5.75	3.20	2.40
15	2.18	2.20	3.50	7.45	9.18	4.50	4.00	5.60	9.00	5.50	3.25	2.45
16	2.22	2.25	3.48	7.52	8.65	4.45	3.40	5.60	10.50	5.40	3.55	2.40
17	2.25	2.22	3.55	7.55	7.60	4.55	3.05	3.70	11.20	4.85	3.25	2.40
18	2.25	2.18	4.25	7.80	6.22	4.80	2.75	4.05	10.40	4.90	2.85	2.35
19	2.32	2.20	6.25	8.30	7.55	3.75	2.85	4.25	9.45	4.90	2.65	2.65
20	2.25	2.18	8.38	7.45	8.72	4.80	2.40	4.05	8.70	4.90	2.85	2.35
21	2.10	2.10	8.85	7.58	9.05	2.30	3.10	3.75	8.00	5.20	2.50	2.30
22	2.20	2.00	7.50	7.05	7.40	3.10	4.20	3.70	6.85	5.30	3.25	2.25
23	2.22	1.95	6.20	6.90	9.40	2.70	3.15	3.75	6.95	4.35	3.00	2.35
24	2.15	2.20	5.95	7.65	6.80	3.10	3.10	3.75	6.35	4.20	3.10	2.30
25	2.12	2.25	5.80	7.50	7.80	2.80	3.25	3.35	5.90	4.05	2.90	2.35
26	2.25	2.32	6.15	7.75	7.15	2.00	4.80	4.05	4.45	3.80	3.00	2.65
27	2.35	2.45	5.42	7.00	8.45	3.80	5.30	4.65	5.50	3.90	2.85	3.15
28	2.25	2.38	5.50	6.45	10.40	2.70	5.70	3.85	4.80	3.85	3.00	3.25
29	2.35	.....	5.15	6.82	11.85	2.45	6.85	3.90	4.40	3.80	3.10	3.10
30	2.35	.....	4.65	7.45	10.10	2.00	8.20	4.00	4.00	3.75	3.60	3.05
31	2.20	.....	4.30	.....	10.75	.....	7.10	4.55	.....	3.70	.....	3.15

IRON RIVER NEAR IRON RIVER, MICH.

This station was established by the engineers of the Oliver Iron Mining Company. It is located at the mine bridge 1 mile below a dam used for ponding logs, which at times causes fluctuations. The gage is a vertical board attached to a braced cedar post at the left end and upstream side of the mine bridge. The gage-height record is kept by the engineers of the mining company. Discharge measurements are made from the mine bridge, which has a span of 30 feet between abutments. The bed of the stream is composed of gravel and small bowlders, and the current is swift. The stream does not freeze over at the gaging station. The pumpage from the mine enters the stream a short distance above the gage; on September 5, 1902, it amounted to 1.7 second-feet. All gage heights have been expressed in terms of their elevation above the mine datum.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Iron River near Iron River, Mich., in 1903.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Second-feet.*
February 28	W. V. Savicki	85.95	51
March 10	R. E. Horton	86.02	62
Do	do	86.02	59
March 19	W. H. Crago	87.45	246
April 11	Crago and Nash	88.36	422
May 20	L. R. Stockman	87.22	194
July 27	E. C. Murphy	86.43	81
April 16	Crago and Love	86.79	134

[a] Elevation water surface. Gage zero = 85.

Mean daily gage height, in feet, of Iron River near Iron River, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	86.35	86.30	86.00	86.40	86.65	87.20	87.00	86.85	87.00	86.65	86.40	86.30
2	86.35	86.25	86.00	87.50	87.30	86.85	86.70	86.80	86.45	86.60	86.40	86.30
3	86.35	86.25	86.00	86.90	87.30	86.80	86.85	86.85	86.45	87.00	86.40	86.30
4	86.35	86.25	86.00	86.37	87.80	86.70	87.30	86.92	86.45	87.10	86.40	86.30
5	86.33	86.20	86.00	86.50	88.00	86.60	86.80	87.58	86.35	86.90	86.40	86.30
6	86.33	86.15	86.00	86.50	87.50	86.55	86.75	87.65	86.35	86.80	86.38	86.30
7	86.30	86.15	86.10	87.65	87.30	86.50	86.50	87.68	87.00	86.85	86.38	86.30
8	86.30	86.15	86.00	86.38	87.00	86.50	86.40	87.38	87.00	86.85	86.38	86.30
9	86.30	86.10	86.00	86.45	86.20	86.45	86.50	87.00	86.80	86.80	86.38	86.40
10	86.30	86.10	86.00	86.50	87.10	86.35	86.65	86.98	86.65	86.80	86.38	86.30
11	86.30	86.10	86.38	87.82	87.40	86.35	86.55	87.08	86.55	86.75	86.40	86.30
12	86.30	86.20	87.22	87.05	87.70	86.35	86.50	86.90	87.22	86.65	86.40	86.30
13	86.30	86.10	86.30	86.97	88.50	86.35	86.50	86.85	87.30	86.60	86.45	86.30
14	86.25	86.10	86.30	86.60	88.32	86.60	86.50	86.75	87.68	86.60	.....	86.30
15	86.25	86.10	86.20	87.00	88.62	86.30	86.50	86.68	88.95	86.60	86.40	86.30
16	86.20	86.00	86.20	86.80	87.20	86.25	86.50	86.60	89.28	86.60	86.40	86.40
17	86.20	86.00	86.25	86.70	87.20	86.25	86.45	86.55	88.70	86.60	86.25	86.40
18	86.20	86.00	86.62	86.70	87.35	86.28	86.45	86.60	88.05	86.55	86.25	86.40
19	86.18	86.00	87.34	86.60	87.35	86.30	86.45	86.65	87.70	86.55	86.25	86.40
20	86.17	86.00	87.20	86.60	87.20	86.30	86.38	86.55	87.40	86.55	86.30	86.40
21	86.17	86.00	86.92	86.55	87.20	86.30	86.40	86.55	87.20	86.50	86.30	86.40
22	86.15	86.00	86.65	86.50	87.00	86.30	86.50	86.50	87.10	86.50	86.30	86.40
23	86.13	86.10	86.60	86.45	86.85	86.32	86.35	86.45	86.95	86.50	86.30	86.40
24	86.10	86.10	86.65	86.45	86.90	86.30	86.35	86.45	86.90	86.50	86.30	86.40
25	86.10	86.10	86.65	86.48	86.90	86.30	86.40	86.50	86.85	86.45	86.30	86.40
26	86.10	86.00	86.50	86.45	87.05	86.28	86.50	86.48	86.80	86.45	86.30	86.40
27	86.10	86.00	86.48	86.45	87.38	86.28	86.45	86.45	86.70	86.45	86.30	86.40
28	86.10	86.00	86.43	86.50	88.08	86.30	87.55	86.45	86.70	86.45	86.30	86.40
29	86.30	.....	86.20	86.50	88.28	86.30	87.40	86.50	86.55	86.45	86.30	86.40
30	86.30	.....	86.20	86.75	87.50	86.30	87.32	86.50	86.65	86.45	86.30	86.40
31	86.30	.....	86.20	.....	87.20	.....	87.00	86.48	.....	86.45	.....	86.40

Rating table for Iron River near Iron River, Mich., from November 9, 1900, to December 31, 1903.

[Stage in terms of elevation of water surface. Gage zero = 85. For open section.]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
85.90	54	86.55	94	87.20	189	87.85	315
85.95	55	86.60	99	87.25	198	87.90	325
86.00	56	86.65	105	87.30	207	87.95	335
86.05	58	86.70	111	87.35	216	88.00	345
86.10	60	86.75	118	87.40	226	88.05	356
86.15	62	86.80	124	87.45	236	88.10	366
86.20	65	86.85	132	87.50	245	88.15	376
86.25	68	86.90	139	87.55	255	88.20	387
86.30	72	86.95	147	87.60	265	88.25	398
86.35	76	87.00	155	87.65	275	88.30	408
86.40	79	87.05	164	87.70	285	88.35	419
86.45	84	87.10	172	87.75	295	88.40	430
86.50	89	87.15	180	87.80	305		

Gage read and discharge computed to hundredths foot elevation.

Mean daily discharge, in second-feet, of Iron River near Iron River, Mich., for 1900 to 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1												61
2												(a)
3												87
4												78
5												72
6												71
7												68
8												64
9											59	(a)
10											83	71
11											(a)	68
12											79	68
13											78	70
14											68	70
15											73	70
16											73	(a)
17											71	68
18											(a)	66
19											72	66
20											71	66
21											76	65
22											86	71
23											68	(a)
24											68	73
25											(a)	(a)
26											71	64
27											68	68
28											59	66
29											(a)	68
30											60	(a)
31												64
Mean											72	69

a No record.

Mean daily discharge, in second-feet, of Iron River near Iron River, Mich., for 1900 to 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	64	64	57	65	158	62	62	.....	.....	.....	.....	.....
2	66	64	58	64	155	(a)	56	.....	.....	.....	.....	.....
3	64	(a)	56	65	132	68	64	.....	.....	.....	.....	.....
4	65	64	(a)	86	118	66	198	.....	.....	.....	.....	.....
5	65	66	58	89	(a)	62	315	.....	.....	.....	.....	.....
6	(a)	64	60	76	105	104	255	.....	.....	.....	.....	.....
7	66	62	59	(a)	98	65	(a)	.....	.....	.....	.....	.....
8	65	60	58	101	89	62	198	.....	.....	.....	.....	.....
9	64	60	59	118	89	(a)	175	.....	.....	.....	.....	.....
10	(a)	(a)	(a)	139	89	81	105	.....	.....	.....	.....	.....
11	66	60	56	186	89	65	111	.....	.....	.....	.....	.....
12	64	72	67	189	(a)	62	99	.....	.....	.....	.....	.....
13	(a)	60	58	203	110	94	89	.....	.....	.....	.....	.....
14	64	60	58	(a)	84	121	(a)	.....	.....	.....	.....	.....
15	64	58	71	211	91	76	76	.....	.....	.....	.....	.....
16	64	59	61	241	99	(a)	66	.....	.....	.....	.....	.....
17	62	(a)	(a)	398	94	68	73	.....	.....	.....	.....	.....
18	65	60	58	345	87	60	68	.....	.....	.....	.....	.....
19	74	61	56	285	(a)	54	68	.....	.....	.....	.....	.....
20	(a)	64	147	245	79	65	68	.....	.....	.....	.....	.....
21	65	64	(a)	(a)	76	65	(a)	.....	.....	.....	.....	.....
22	62	60	59	172	79	99	99	.....	.....	.....	.....	.....
23	62	59	58	175	84	(a)	79	.....	.....	.....	.....	.....
24	62	(a)	(a)	172	112	68	.....	.....	.....	.....	.....	.....
25	62	59	64	169	79	72	.....	.....	.....	.....	.....	.....
26	62	60	132	158	(a)	71	.....	.....	.....	.....	.....	.....
27	(a)	57	(a)	147	72	81	.....	.....	.....	.....	.....	.....
28	62	62	65	(a)	87	64	.....	.....	.....	.....	.....	.....
29	62	.....	64	132	65	64	.....	.....	.....	.....	.....	.....
30	61	.....	64	155	64	(a)	.....	.....	.....	.....	.....	.....
31	61	.....	(a)	.....	62	.....	.....	.....	.....	.....	.....	.....
Mean	64	62	67	169	94	73	.....	.....	.....	.....	.....	.....

a No record.

Mean daily discharge, in second-feet, of Iron River near Iron River, Mich., for 1900 to 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	.....	.....	62	89	117	56	62	58	58	58	62	335
2	.....	.....	56	81	155	132	65	59	60	58	65	79
3	.....	.....	61	76	155	189	72	56	132	58	62	79
4	.....	.....	54	76	139	118	(a)	b 42	54	58	62	76
5	.....	.....	63	76	124	94	72	b 42	b 45	58	62	74
6	.....	.....	61	72	155	79	(a)	55	56	59	61	74
7	.....	.....	62	76	172	72	62	65	54	58	59	74
8	.....	.....	61	70	155	72	60	65	55	60	59	74
9	.....	.....	62	70	139	114	60	56	60	59	58	74
10	.....	.....	65	72	124	84	55	54	58	58	62	74
11	.....	.....	96	72	99	84	55	54	54	60	65	74
12	.....	.....	80	79	99	79	(a)	b 45	60	59	75	72
13	.....	.....	72	72	99	84	b 45	54	58	60	186	72
14	.....	.....	73	68	89	81	54	b 45	56	60	202	72
15	.....	.....	81	72	89	72	56	65	b 45	58	164	72
16	.....	.....	72	65	89	66	60	60	255	58	79	72
17	.....	.....	68	68	84	68	56	56	155	60	76	72
18	.....	.....	66	72	76	66	56	54	b 45	60	74	72
19	.....	.....	71	68	72	66	56	55	b 26	59	74	72
20	.....	.....	68	65	74	65	60	56	b 42	59	74	73
21	.....	.....	68	66	79	68	65	65	(a)	59	74	73
22	.....	.....	71	68	79	66	84	54	124	59	74	73
23	.....	.....	(a)	84	76	65	60	55	94	60	74	73
24	.....	.....	89	79	76	68	60	b 45	b 42	124	74	73
25	.....	.....	94	72	(a)	72	60	55	56	68	74	73
26	.....	.....	110	198	60	91	56	56	56	68	74	73
27	.....	.....	101	255	60	65	56	54	58	68	74	73
28	.....	.....	109	245	56	65	55	54	(a)	65	74	72
29	.....	.....	109	216	56	(a)	55	60	58	65	74	72
30	.....	.....	101	62	61	62	60	139	58	65	74	72
31	.....	.....	94	.....	58	.....	58	111	.....	65	.....	
Mean	.....	.....	77	93	100	81	60	59	70	63	81	82

a No record. b Approximate discharge by logarithmic extension of curve.

Mean daily discharge, in second-feet, of Iron River near Iron River, Mich., for 1900 to 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	76	72	56	79	105	189	155	132	155	105	79	72
2	76	68	56	245	207	132	111	124	84	99	79	72
3	76	68	56	139	207	124	132	132	84	155	79	72
4	76	68	56	77	305	111	207	142	84	172	79	72
5	74	65	56	89	345	99	124	261	76	139	79	72
6	74	62	56	89	245	94	118	275	76	124	78	72
7	72	62	60	275	207	89	89	281	155	132	78	72
8	72	62	56	78	155	89	79	222	155	132	78	72
9	72	60	56	84	65	84	89	155	124	124	78	79
10	72	60	56	89	172	76	105	152	105	124	78	72
11	72	60	78	309	226	76	94	169	94	118	79	72
12	72	65	193	164	285	76	89	139	193	105	79	72
13	72	60	72	150	[b] 455	76	89	132	207	99	84	72
14	68	60	72	99	412	99	89	118	281	99	([a])	72
15	68	60	65	155	[b] 500	72	89	109	[b] 600	99	79	72
16	65	56	65	124	189	68	89	99	[b] 715	99	79	79
17	65	56	68	111	189	68	84	94	[b] 525	99	68	79
18	65	56	101	111	216	71	84	99	356	94	68	79
19	64	56	215	99	216	72	84	105	285	94	68	79
20	64	56	189	99	189	72	78	94	226	94	72	79
21	64	56	142	94	189	72	79	94	189	89	72	79
22	62	56	105	89	155	72	89	89	172	89	72	79
23	62	60	99	84	132	73	76	84	147	89	72	79
24	60	60	105	84	139	72	76	84	139	89	72	79
25	60	60	105	87	139	72	79	89	132	84	72	79
26	60	56	89	84	164	71	89	87	124	84	72	79
27	60	56	87	84	222	71	84	84	111	84	72	79
28	60	56	82	89	362	72	255	84	111	84	72	79
29	72	.....	65	89	404	72	226	89	94	84	72	79
30	72	.....	65	118	245	72	211	89	105	84	72	79
31	72	.....	65	.....	189	.....	155	87	.....	84	.....	79
Mean	68	60	87	119	233	85	113	129	197	105	75	76

[a] No record. [b] Approximate discharge by logarithmic extension of curve.

Estimated monthly discharge of Iron River near Iron River, Mich., for 1900 to 1903.

[Drainage area, 75 square miles.]

Date.	Discharge in second-feet.			Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1900.						
November	86	59	72	0.96	1.07	2.02
December	87	61	69	.92	1.06	1.10
1901.						
January	74	61	64	.86	.99	.80
February	72	57	62	.83	.86	.40
March	147	56	67	.90	1.04	3.25
April	398	64	169	2.26	2.52	1.46
May	158	62	94	1.26	1.45	2.66
June	121	54	73	.98	1.09	5.27
July	315	56	116	1.55	1.79	10.40
1902.						
March	110	54	77	1.03	1.19	.....
April	255	62	93	1.25	1.39	2.60
May	172	56	100	1.34	1.54	2.10
June	189	56	81	1.09	1.22	5.15
July	84	45	60	.80	.92	3.50
August	139	42	59	.79	.91	2.15
September	255	26	70	.94	1.04	2.65
October	124	58	63	.84	.97	3.55
November	202	58	81	1.09	1.22	4.30
December	335	72	82	1.10	1.27	2.45
1903.						
January	76	60	68	.91	1.05	.45
February	72	56	60	.80	.83	.60
March	215	56	87	1.17	1.35	2.70
April	309	77	119	1.59	1.77	10.50
May	500	65	233	3.12	3.60	6.45
June	189	68	85	1.14	1.27	1.60
July	255	76	113	1.51	1.74	9.50
August	281	84	129	1.73	1.99	5.55
September	715	76	197	2.64	2.95	6.60
October	172	84	105	1.41	1.63	3.30
November	84	68	75	1.01	1.13	1.40
December	79	72	76	1.02	1.18	.95
The year	715	56	112	1.50	20.49	49.60

ESCANABA RIVER NEAR ESCANABA, MICH.

Escanaba River rises near Ishpeming, southwest of Lake Superior in Upper Peninsula, Michigan, and flows southeasterly a distance of 70 miles, entering Lake Michigan through Little Bay de Noquette. The gaging station is located 4 miles above the mouth of the river at a single-span highway bridge, where a chain gage was established in June, 1903. Gage readings were made once each day from August 25 to November 21, 1903, by Henry Beauchamp. The bed of the stream is covered with small bowlders and is rough but permanent. The current is swift. During the winter the channel is filled with ice, and it is impossible to make discharge measurements. The channel is nearly straight and is 195 feet wide between bridge abutments without piers.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Escanaba River, near Escanaba, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 10	L. R. Stockman	[a]4.18	[b]1,870
May 30	do	4.63	3,458
July 14	do	2.63	751
July 25	E. C. Murphy	2.58	762
August 24	L. R. Stockman	2.57	701
September 11	do	3.30	1,448
October 26	do	2.88	973

[a] Referred to gage used after August 24, 1903. [b] Log jam below.

Mean daily gage height, in feet, of Escanaba River near Escanaba, Mich., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1		3.60	2.80	2.80	17		4.30	3.30	3.00
2		3.40	2.90	2.80	18		4.30	3.20	2.90
3		3.20	3.20	2.90	19		4.20	3.20	3.10
4		3.10	4.30	2.90	20		4.00	3.20	2.80
5		3.00	4.50	2.80	21		3.70	3.10	2.90
6		2.80	4.40	2.80	22		3.50	3.00	
7		2.90	4.40	2.90	23		3.30	3.00	
8		3.20	4.30	2.90	24		3.20	3.00	
9		3.50	4.30	3.00	25	2.60	3.20	2.90	
10		3.70	4.00	3.00	26	2.50	3.00	2.90	
11		3.50	3.90	2.90	27	3.50	2.90	2.80	
12		3.30	3.80	2.90	28	3.40	2.90	2.90	
13		3.60	3.40	2.80	29	3.30	2.80	2.80	
14		3.70	3.40	3.05	30	3.50	2.80	2.80	
15		3.90	3.40	3.00	31	3.60		2.70	
16		4.20	3.30	3.10					

Discharge measurements of Little Portage River at Mendon, Mich., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 3	W. M. Gregory		57
August 4	Horton and Murphy	1.22	25
August 31	W. M. Gregory		26

LAKE SUPERIOR DRAINAGE IN MICHIGAN.

The western boundary of Upper Peninsula, Michigan, is formed by Montreal River.

Passing to the east, the more important tributary streams of Lake Superior from the south are Black, Presqueisle, Iron, Ontonagon, Sturgeon, Yellow Dog, Dead, Carp, and Tah-qua-me-non rivers.

The following is a list of the stations maintained during 1903 in the Lake Superior drainage:

Carp River near Marquette, Mich.
Dead River at "The Hoist" near Negaunee, Mich.
Ontonagon River near Rockland, Mich.
St. Louis River near Cloquet, Minn.

CARP RIVER NEAR MARQUETTE, MICH.

A weir was erected 500 feet above the mouth of the stream by the Cleveland-Cliffs Iron Company, and the daily gage record was started July 5, 1902. The gage readings have been furnished by Noah Gray, superintendent of the furnace. The weir has a level crest 10.04 feet in length, with two end contractions. The water flows over a sharp edge or crest lip, but falls on a nearly horizontal apron at a slightly lower level on the downstream side. In order to calculate the discharge of the nappe as modified by the apron, the weir formula of Bazin, using coefficients from experiment series No. 142, has been used. During high stages of the stream the water also flows over the flashboards forming the wings of the weir. The gage is attached vertically to a framework 16 feet upstream, and the same distance to the left of the weir crest.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Mean daily discharge, in second-feet, of Carp River near Marquette, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	.....	.....	136	110	190	122	82	136	71
2	.....	.....	.....	160	122	168	129	76	129	71
3	.....	.....	.....	151	168	151	136	79	126	82
4	.....	.....	.....	151	219	129	136	76	122	104
5	.....	42	.....	151	219	104	143	98	110	122
6	.....	.....	.....	151	219	98	151	110	98	122
7	.....	.....	.....	151	219	82	151	107	92	129
8	.....	.....	.....	151	204	76	136	101	90	129
9	.....	.....	.....	151	168	76	122	98	87	122
10	.....	40	52	164	151	71	110	98	87	116
11	.....	.....	.....	190	168	71	98	122	82	116
12	.....	.....	71	219	219	66	87	122	87	104
13	.....	.....	90	204	219	64	82	122	104	104
14	.....	.....	104	190	168	61	71	124	122	101
15	.....	.....	122	178	160	56	66	129	151	92
16	.....	.....	104	168	160	58	56	122	160	87
17	.....	.....	122	160	151	61	56	116	174	87
18	.....	.....	168	151	143	64	57	92	178	87
19	.....	.....	168	151	151	61	76	82	178	82
20	.....	.....	219	151	168	58	76	71	160	82
21	.....	.....	219	151	190	61	71	61	140	71
22	.....	.....	219	143	190	76	68	56	129	71
23	.....	.....	219	143	168	87	64	56	119	66
24	.....	.....	168	136	129	109	58	52	107	66
25	38	36	151	129	116	122	56	116	92	66
26	.....	.....	151	122	143	136	52	110	84	66
27	.....	.....	143	122	160	143	52	104	76	61
28	.....	.....	140	119	190	136	71	104	76	61
29	.....	.....	140	116	204	116	98	122	76	(a)
30	.....	.....	122	113	219	98	98	151	71	.....
31	.....	.....	129	.....	219	.....	87	151	.....	.....
Mean	38	39	144	152	175	95	91	100	115	91

a Record discontinued.

Estimated monthly discharge of Carp River near Marquette, Mich., in 1903.

[Drainage area, 86 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 10–31	219	52	144	1.67	1.93
April	219	113	152	1.76	1.96
May	219	110	175	2.03	2.34
June	190	56	95	1.10	1.23
July	151	52	91	1.06	1.22
August	151	52	100	1.16	1.34
September	178	71	115	1.33	1.48
October 1–28	129	61	91	1.06	1.22

DEAD RIVER NEAR NEGAUNEE, MICH.

July 10, 1902, a gaging record was started at "The Hoist," under the direction of Frank Drake, chief engineer of the Oliver Iron Mining Company, Duluth, Minn. A suitable cross section was selected and a cableway of 91 feet span was erected across the stream about 700 feet south of the lumbermen's dam. The gaging station is located in the northeast portion of T. 48 N., R. 27 W. The stage of the stream is observed daily and current-meter discharge measurements are made from time to time. The hydrographic work has been done by C. G. Mason, M. E., acting in cooperation with the United States Geological Survey. The bed of the stream is rock and the velocity of the current relatively high. These features, together with the location just below a dam, tend to keep the gaging section open during winter.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Dead River near Negaunee, Mich., in 1903.

Date.	Hydrographer.	Elevation water surface.	Discharge.
		Feet.	*Second-feet.*
January 23	C. G. Mason	10.85	[a]126
January 29	do	10.70	[a]119
May 25	L. R. Stockman	11.20	301

[a] Ice in stream bed.

Mean daily gage height, in feet, of Dead River near Negaunee, Mich., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	10.45	10.50	10.55	11.10	11.40	17	10.55	10.50	10.75	11.80	.....
2	10.50	10.45	10.60	11.05	11.40	18	10.50	10.45	10.85	11.90	.....
3	10.45	10.45	10.50	11.05	11.50	19	10.60	10.45	11.00	11.90	.....
4	10.40	10.40	10.55	11.10	11.30	20	10.55	10.45	11.15	11.90	.....
5	10.40	10.45	10.60	11.20	11.20	21	10.55	10.50	11.20	11.90	.....
6	10.45	10.60	10.65	11.30	12.40	22	11.00	10.55	11.20	11.90	.....
7	10.45	10.60	10.55	11.35	12.50	23	10.80	10.60	11.20	11.90	.....
8	10.45	10.55	10.60	11.35	12.20	24	10.70	10.55	11.15	11.90	.....
9	10.50	10.50	10.70	11.35	11.40	25	10.70	10.55	11.05	11.80	.....
10	10.45	10.50	10.65	11.40	11.50	26	10.70	10.60	11.00	11.80	.....
11	10.40	10.50	10.70	11.60	11.70	27	10.65	10.50	11.00	11.75	.....
12	10.35	10.60	10.75	11.70	12.10	28	10.70	10.55	10.95	11.80	.....
13	10.40	10.60	10.80	11.80	12.30	29	10.70	.....	10.90	11.90	.....
14	10.45	10.65	10.80	11.70	11.10	30	10.70	.....	10.95	12.00	.....
15	10.50	10.60	.....	11.65	11.40	31	10.65	.....	11.05	.....	.....
16	10.55	10.55	10.75	11.60	11.90						

Rating table for Dead River near Negaunee, Mich., for ice-free periods.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
10.45	65	10.70	135	10.90	196	11.10	263
10.50	79	10.75	149	10.95	212	11.15	280
10.55	93	10.80	165	11.00	228	11.20	298
10.60	107	10.85	181	11.05	245	11.25	315
10.65	121						

Mean daily discharge, in second-feet, of Dead River near Negaunee, Mich., for 1902 and 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	.....	.....	.....	.....	.....	.....	.....	107	135	93	165	107
2	.....	.....	.....	.....	.....	.....	.....	107	135	93	181	93
3	.....	.....	.....	.....	.....	.....	.....	107	149	93	212	196
4	.....	.....	.....	.....	.....	.....	.....	107	165	93	165	165
5	.....	.....	.....	.....	.....	.....	.....	121	149	78	165	149
6	.....	.....	.....	.....	.....	.....	.....	121	149	78	149	165
7	.....	.....	.....	.....	.....	.....	.....	107	135	78	135	181
8	.....	.....	.....	.....	.....	.....	.....	93	135	93	121	135
9	.....	.....	.....	.....	.....	.....	.....	107	135	93	135	121
10	.....	.....	.....	.....	.....	.....	149	93	121	93	121	107
11	.....	.....	.....	.....	.....	.....	135	93	121	93	121	107
12	.....	.....	.....	.....	.....	.....	121	93	121	107	298	93
13	.....	.....	.....	.....	.....	.....	121	93	121	121	315	93
14	.....	.....	.....	.....	.....	.....	107	93	107	135	427	78
15	.....	.....	.....	.....	.....	.....	107	93	107	165	245	78
16	.....	.....	.....	.....	.....	.....	107	98	107	135	165	93
17	.....	.....	.....	.....	.....	.....	121	107	121	93	245	93
18	.....	.....	.....	.....	.....	.....	107	107	121	107	181	78
19	.....	.....	.....	.....	.....	.....	93	149	107	93	181	78
20	.....	.....	.....	.....	.....	.....	107	149	107	93	245	78
21	.....	.....	.....	.....	.....	.....	107	135	121	107	135	65
22	.....	.....	.....	.....	.....	.....	107	135	121	149	135	65
23	.....	.....	.....	.....	.....	.....	107	121	135	181	149	78
24	.....	.....	.....	.....	.....	.....	121	121	107	371	135	165
25	.....	.....	.....	.....	.....	.....	121	121	107	389	121	196
26	.....	.....	.....	.....	.....	.....	149	107	107	371	107	135
27	.....	.....	.....	.....	.....	.....	135	107	107	263	107	121
28	.....	.....	.....	.....	.....	.....	121	107	93	245	107	78
29	.....	.....	.....	.....	.....	.....	107	121	93	196	93	78
30	.....	.....	.....	.....	.....	.....	107	121	93	165	107	65
31	.....	.....	.....	.....	.....	.....	107	149	.....	165	.....	65
Mean	.....	.....	.....	.....	.....	.....	116	112	121	149	172	110

Mean daily discharge, in second-feet, of Dead River near Negaunee, Mich., for 1902 and 1903—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	65	a 76	93	b 263	b 371	.....	.....	.....	.....	.....	.....	.....
2	78	65	107	b 245	b 371	.....	.....	.....	.....	.....	.....	.....
3	65	65	78	b 245	b 408	.....	.....	.....	.....	.....	.....	.....
4	51	51	93	b 263	b 334	.....	.....	.....	.....	.....	.....	.....
5	51	65	107	b 298	b 298	.....	.....	.....	.....	.....	.....	.....
6	65	107	121	b 334	b 765	.....	.....	.....	.....	.....	.....	.....
7	65	107	93	b 352	b 806	.....	.....	.....	.....	.....	.....	.....
8	65	93	107	b 352	b 683	.....	.....	.....	.....	.....	.....	.....
9	78	78	135	b 352	b 371	.....	.....	.....	.....	.....	.....	.....
10	65	78	121	b 371	b 408	.....	.....	.....	.....	.....	.....	.....
11	51	78	135	b 446	b 485	.....	.....	.....	.....	.....	.....	.....
12	39	107	149	b 485	b 642	.....	.....	.....	.....	.....	.....	.....
13	51	107	165	b 524	b 724	.....	.....	.....	.....	.....	.....	.....
14	65	121	165	b 485	b 263	.....	.....	.....	.....	.....	.....	.....
15	78	107	.....	b 466	b 371	.....	.....	.....	.....	.....	.....	.....
16	93	93	149	b 446	b 563	.....	.....	.....	.....	.....	.....	.....
17	93	78	149	b 524	.....	.....	.....	.....	.....	.....	.....	.....
18	78	65	181	b 563	.....	.....	.....	.....	.....	.....	.....	.....
19	107	65	228	b 563	.....	.....	.....	.....	.....	.....	.....	.....
20	93	65	280	b 563	.....	.....	.....	.....	.....	.....	.....	.....
21	93	78	298	b 563	.....	.....	.....	.....	.....	.....	.....	.....
22	a 153	93	298	b 563	.....	.....	.....	.....	.....	.....	.....	.....
23	a 116	107	298	b 563	.....	.....	.....	.....	.....	.....	.....	.....
24	a 98	93	280	b 563	.....	.....	.....	.....	.....	.....	.....	.....
25	a 103	93	245	b 524	.....	.....	.....	.....	.....	.....	.....	.....
26	a 107	107	228	b 524	.....	.....	.....	.....	.....	.....	.....	.....
27	a 99	78	228	b 504	.....	.....	.....	.....	.....	.....	.....	.....
28	a 115	93	212	b 524	.....	.....	.....	.....	.....	.....	.....	.....
29	a 119	.....	196	b 563	.....	.....	.....	.....	.....	.....	.....	.....
30	a 123	.....	212	b 602	.....	.....	.....	.....	.....	.....	.....	.....
31	a 114	.....	245	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	85	86	180	454	.....	.....	.....	.....	.....	.....	.....	.....

a Ice in stream bed; approximate.
b Mainly from logarithmic extension of rating curve; approximate.

DEAD RIVER AT FORESTVILLE, MICH.

A record of the gage heights above the crest of a weir was maintained at Forestville from October 15, 1898, to July 31, 1902, inclusive, by J. M. Longyear, of Marquette. The weir is of timber, with a rounded crest. A cross section and profile of the crest in relation to the gage have been furnished by Charles Cumings, C. E. From this profile a discharge curve has been computed, using coefficients derived from the experiments of the United States Geological Survey and at Cornell University, and the daily flow has been determined. The estimated monthly run-off is only approximate, the boundary of the drainage area, which comprises a rugged forest-covered wilderness, not being determined. The rainfall estimated from records at three

stations lying along the southern boundary of the drainage basin is also given. These records indicate large local variations in the precipitation. There is no statement of ice conditions at the weir in conjunction with the record. The estimated flow for the winter months may therefore be somewhat uncertain. As a check the record has been compared with simultaneous observations for two different periods at "The Hoist," near Negaunee, substantial agreement being found.

Mean daily discharge, in second-feet, of Dead River at Forestville, Mich., 1898–1902.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	492	167
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	430	145
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	430	126
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	385	.....
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	415	126
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	508	108
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	382	104
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	296	94
10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	248	94
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	217	.....
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	224	112
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	108
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	194	108
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	178	99
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	172	94
17	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	156	90
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	90	150	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	.....	108	150	108
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	108	.....	117
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	108	156	108
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	126	189	94
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	274	96
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	145	300	112
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	167	211	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	189	200	94
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	167	.....	94
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	145	200	99
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	145	200	94
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	178	90
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	524	.....	90

Mean daily discharge, in second-feet, of Dead River at Forestville, Mich., 1898–1902—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1	.....	90	50	57	1,270	452	242	194	370	236	356	189
2	.....	68	57	65	984	408	200	184	328	267	335	178
3	.....	61	65	72	725	400	172	189	274	321	314	167
4	.....	54	68	75	621	500	145	184	255	328	300	145
5	.....	47	57	75	516	476	130	135	261	286	274	140
6	75	54	50	72	438	438	126	126	248	248	217	184
7	79	50	57	79	370	370	236	117	374	242	200	189
8	.....	50	50	82	349	349	267	108	779	236	194	194
9	68	50	54	82	328	307	217	117	690	224	189	236
10	65	42	57	94	307	261	178	112	500	217	178	242
11	65	40	54	178	314	206	156	108	400	211	172	261
12	68	37	40	274	300	261	140	130	385	206	194	242
13	75	42	45	408	280	460	126	117	342	200	189	206
14	79	30	34	817	274	596	112	112	274	342	178	236
15	.....	50	40	1,090	242	500	117	108	261	433	189	274
16	82	65	47	1,520	508	430	150	99	236	751	206	248
17	82	65	50	1,720	846	378	255	90	230	817	200	242
18	79	68	65	1,720	894	540	255	117	314	664	194	236
19	75	65	57	1,820	770	588	189	130	307	508	184	224
20	79	68	65	1,840	699	445	172	178	267	422	172	206
21	79	61	68	1,860	638	314	156	206	206	385	206	194
22	.....	68	68	1,420	438	274	145	140	189	342	261	194
23	82	50	72	1,570	300	242	140	126	178	335	242	184
24	82	54	65	1,820	248	224	126	112	167	363	206	172
25	75	65	65	1,920	242	189	189	99	162	445	194	145
26	68	.....	68	2,130	236	167	172	122	172	655	200	156
27	54	57	72	2,170	392	162	162	117	200	699	194	172
28	68	54	68	2,320	596	274	172	99	194	588	189	200
29	.....	.....	57	(b)	508	370	236	224	189	468	184	206
30	117	.....	54	1,920	500	321	267	588	184	415	184	189
31	126	.....	50	.....	492	.....	206	484	.....	363	.....	194

Mean daily discharge, in second-feet, of Dead River at Forestville, Mich., 1898–1902—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	224	189	140	135	484	261	314	178	90	286	217	117
2	217	184	130	130	492	274	274	150	94	274	314	145
3	211	172	112	150	408	300	167	126	140	267	400	15[illegible]
4	206	156	126	172	392	267	150	130	167	236	370	150
5	189	145	122	206	328	224	172	108	162	217	335	150
6	172	150	117	293	217	217	189	99	255	217	267	145
7	167	145	130	430	236	236	178	167	415	224	267	145
8	167	145	145	596	230	224	145	280	307	224	248	140
9	178	126	135	638	248	217	135	300	236	236	236	140
10	167	122	126	630	300	211	130	349	189	211	230	140
11	162	126	112	588	293	200	145	286	242	206	230	135
12	150	130	108	500	264	217	140	248	708	189	224	135
13	145	135	130	452	321	261	145	206	884	172	194	130
14	145	145	122	415	274	267	156	172	548	167	189	126
15	150	145	112	415	314	236	167	145	385	167	167	126
16	150	140	126	540	280	224	224	135	422	178	189	135
17	145	135	126	770	430	236	314	126	468	172	189	145
18	140	145	122	1,590	572	217	206	117	760	172	194	145
19	145	145	117	1,710	516	206	217	86	604	167	189	145
20	150	135	122	1,860	408	150	200	130	548	162	178	150
21	162	130	126	2,260	307	108	167	140	460	156	167	140
22	167	126	117	(b)	286	117	156	126	430	150	162	140
23	172	122	126	2,340	255	172	162	117	492	150	156	145
24	172	117	117	1,790	248	126	167	112	452	167	145	172
25	178	126	126	1,620	242	122	145	108	430	178	145	206
26	184	145	130	1,360	230	117	135	104	415	167	135	206
27	189	140	126	1,050	242	117	112	99	342	162	126	200
28	189	145	108	779	236	112	108	90	307	162	126	194
29	178	.....	117	699	224	108	126	90	293	172	122	194
30	172	.....	126	638	280	122	156	86	300	211	117	194
31	167	.....	122	.....	328	.....	145	90	.....	217	.....	189

Mean daily discharge, in second-feet, of Dead River at Forestville, Mich., 1898–1902—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	172	117	126	130	508	242	150	99	122	194	217	184
2	194	108	117	126	874	286	130	122	167	178	236	156
3	200	108	126	156	1,110	363	122	126	150	167	230	150
4	206	112	122	184	655	274	90	117	145	162	189	145
5	200	112	117	194	548	189	135	112	135	150	156	135
6	189	112	112	211	400	242	255	99	122	145	156	150
7	184	108	126	274	293	200	492	99	94	140	145	167
8	189	108	122	286	261	167	445	90	90	156	130	162
9	194	112	117	293	248	162	378	86	82	172	126	178
10	200	112	122	300	438	242	342	75	75	206	140	172
11	178	117	117	314	646	328	167	94	86	224	145	162
12	162	117	126	378	1,040	286	122	117	90	236	224	135
13	150	122	122	540	314	267	248	140	117	267	630	130
14	145	122	126	716	261	230	460	140	117	314	621	117
15	145	126	126	836	855	189	321	156	145	328	452	104
16	140	117	122	1,210	914	178	167	126	172	293	242	108
17	140	108	117	1,580	826	150	135	112	156	280	206	112
18	126	108	108	2,210	725	122	104	90	140	189	172	122
19	135	112	112	1,650	596	108	79	90	140	184	156	122
20	145	112	117	1,200	588	117	61	61	126	167	172	117
21	140	108	99	.....	476	126	72	72	112	145	145	126
22	135	112	94	760	255	117	99	108	99	145	172	130
23	135	112	117	808	314	140	108	130	90	140	200	126
24	140	108	104	984	664	167	130	140	90	126	189	117
25	126	104	126	1,290	328	267	156	126	86	117	184	112
26	122	104	135	1,630	261	370	236	117	82	117	178	112
27	117	104	130	1,200	788	206	392	94	82	112	167	108
28	117	108	126	1,210	314	167	492	90	172	108	126	108
29	108	.....	135	770	224	156	242	82	211	117	135	112
30	108	.....	130	588	172	126	156	90	255	122	140	104
31	117	.....	135	.....	370	.....	108	94	.....	126	.....	99

Mean daily discharge, in second-feet, of Dead River at Forestville, Mich., 1898–1902—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	86	122	135	638	1,880	236	126	.....	.....	.....	.....	.....
2	86	122	130	588	1,260	217	135	.....	.....	.....	.....	.....
3	82	126	126	532	1,120	335	150	.....	.....	.....	.....	.....
4	90	126	126	516	708	286	178	.....	.....	.....	.....	.....
5	94	126	130	492	596	274	167	.....	.....	.....	.....	.....
6	104	117	135	445	621	224	363	.....	.....	.....	.....	.....
7	117	108	130	314	788	349	242	.....	.....	.....	.....	.....
8	126	104	130	438	699	286	194	.....	.....	.....	.....	.....
9	122	94	140	385	646	342	189	.....	.....	.....	.....	.....
10	126	94	156	630	572	307	178	.....	.....	.....	.....	.....
11	117	99	172	681	588	300	162	.....	.....	.....	.....	.....
12	112	99	236	914	516	286	150	.....	.....	.....	.....	.....
13	117	99	314	855	438	242	145	.....	.....	.....	.....	.....
14	122	94	356	690	430	200	145	.....	.....	.....	.....	.....
15	126	94	392	646	415	184	135	.....	.....	.....	.....	.....
16	117	90	430	664	392	167	126	.....	.....	.....	.....	.....
17	112	86	349	725	328	145	122	.....	.....	.....	.....	.....
18	117	86	385	445	286	135	122	.....	.....	.....	.....	.....
19	117	90	342	484	194	140	117	.....	.....	.....	.....	.....
20	122	90	335	524	167	150	108	.....	.....	.....	.....	.....
21	122	94	286	508	370	1,100	108	.....	.....	.....	.....	.....
22	112	94	300	460	314	314	99	.....	.....	.....	.....	.....
23	112	99	321	596	248	280	108	.....	.....	.....	.....	.....
24	108	108	342	672	293	248	112	.....	.....	.....	.....	.....
25	117	112	422	548	314	194	126	.....	.....	.....	.....	.....
26	122	117	460	760	363	162	135	.....	.....	.....	.....	.....
27	122	122	596	1,140	438	145	145	.....	.....	.....	.....	.....
28	126	126	864	1,560	385	145	162	.....	.....	.....	.....	.....
29	156	.....	1,140	2,030	293	135	162	.....	.....	.....	.....	.....
30	130	.....	1,090	2,210	206	130	150	.....	.....	.....	.....	.....
31	126	.....	836	.....	167	.....	145	.....	.....	.....	.....	.....

Estimated monthly discharge of Dead River at Forestville, Mich.

[Drainage area, 142[a] square miles.]

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.[b]
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1898.						
January						1.08
February						2.62
March						1.57
April						1.17
May						3.25
June						4.38
July						1.67
August						1.06
September						2.42
October 15–31			153	1.08	1.24	2.74
November	508	150	267	1.88	2.11	1.64
December	167	90	107	.75	.86	1.35
1899.						
January	126	54	78	.55	.63	1.54
February	90	30	56	.39	.41	.75
March	72	34	57	.40	.46	3.58
April	2,320	57	1,009	7.10	7.96	3.11
May	1,270	236	502	3.53	4.06	4.20
June	596	162	363	2.56	2.86	4.84
July	267	112	179	1.26	1.45	3.85
August	588	90	160	1.13	1.30	4.17
September	874	162	314	2.21	2.48	4.71
October	817	200	394	2.77	3.19	3.83
November	356	172	216	1.52	1.70	.39
December	274	140	201	1.42	1.63	2.78
The year	2,320	30	294	2.07	28.13	37.75

[a] Approximate.
[b] Mean of Marquette, Ishpeming, and Humboldt observations

Estimated monthly discharge of Dead River at Forestville, Mich.—Continued.

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.	
1900.						
January	224	140	171	1.20	1.38	1.03
February	189	117	142	1.00	1.04	1.77
March	140	108	123	.87	1.00	1.29
April	2,340	130	854	6.01	6.73	2.63
May	572	217	319	2.25	2.58	2.53
June	300	108	196	1.38	1.55	2.33
July	314	108	172	1.21	1.39	5.95
August	349	90	156	1.10	1.26	3.11
September	884	90	385	2.71	3.04	8.23
October	286	150	195	1.37	1.58	2.36
November	400	117	208	1.46	1.64	1.02
December	206	117	154	1.08	1.25	.93
The year	2,340	90	256	1.80	24.44	33.18
1901.						
January	206	108	154	1.08	1.25	1.30
February	126	104	112	.79	.82	.64
March	135	94	120	.84	.97	2.21
April	2,210	126	760	5.35	5.99	1.63
May	1,110	172	525	3.70	4.25	3.72
June	370	108	206	1.45	1.62	3.34
July	492	90	228	1.60	1.85	5.44
August	156	90	112	.79	.91	2.08
September	255	90	136	.96	1.07	3.90
October	328	108	178	1.25	1.44	3.04
November	630	126	213	1.50	1.68	2.46
December	184	99	132	.93	1.07	1.41
The year	2,210	90	240	1.69	22.92	31.17

Estimated monthly discharge of Dead River at Forestville, Mich.—Continued.

Month.	Discharge in second-feet.			Run-off.		Rainfall in inches.
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.[a]	
1902.						
January	156	90	118	.83	.96	1.43
February	126	90	106	.75	.78	1.06
March	1,140	126	362	2.55	2.93	.87
April	2,210	314	736	5.18	5.80	2.26
May	1,880	167	517	3.64	4.19	2.53
June	1,100	130	255	1.80	2.01	3.31
July	363	99	152	1.07	1.23	3.49
August						1.62
September						1.54
October						2.48
November						2.82
December						2.09

[a] Includes flow from snow accumulated on ground, Dec. 31, 1901.

ONTONAGON RIVER NEAR ROCKLAND, MICH.

This station was established by L. R. Stockman in May, 1903. It is located at the highway bridge on the road between Rockland and Victoria mine. Discharge measurements are made from the single-span highway bridge. The initial point for soundings is the left edge of the covering of the left abutment; the point is marked zero on the bridge floor. The channel is straight for 300 feet above and for 250 feet below the station. Both banks are high, rocky, and wooded. The bed of the stream is composed of gravel and rocks, and there is but one channel at all stages. The velocity of the current is sufficient to be measured at low water. The water surface when discharge measurements have been made has been referred to a cross on the hand rail of the bridge on the downstream side 20 feet from the initial point for soundings. Its elevation is 4.19 feet above bench mark No. 1 and 5.64 feet above bench mark No. 2. Bench mark No. 1 is a spike in the root of a double elm tree about 150 feet south of the south abutment and just to the right of the highway leading to Victoria mine. Bench mark No. 2 is a spike in the root of an elm tree, 3½ feet in diameter, and about 50 feet south of the south bridge abutment.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Ontonagon River near Rockland, Mich., in 1902–3.

Date.	Hydrographer.	Gage height.[a]	Discharge.
1902.		*Feet.*	*Second-feet.*
September 14	W. V. Savicki	24.88	533
November 16	do	21.20	3,717
1903.			
May 22	L. R. Stockman	21.40	3,526
July 20	do	24.50	658
September 17	do	19.55	4,733

[a] Distance to water surface from reference point. Top of hand rail 20 feet from zero of distance downstream side.

ST. LOUIS RIVER NEAR CLOQUET, MINN.

This station was established May 26, 1903, by E. Johnson, jr. It is located at "The Works," a place where logs are separated for individual owners, about 4 miles above Cloquet, Minn. The gage is a 1½ by 6 inch timber, fastened to the timber crib. It is read once each day by M. J. Crawford. Discharge measurements are made by means of a cable and boat. The initial point for soundings has been taken at the water's edge on the left bank. The channel is straight for 1,500 feet above and for 3,000 feet below the station. The current has a moderate velocity. The right bank is low and may overflow at extreme high water, the left bank is high and not liable to overflow, both are wooded. The bed of the stream is sandy, free from vegetation, and is subject to some change. There is but one channel at ordinary and high stages. The bench mark is on a 15-inch pine tree, about 100 feet upstream from the cable. Its elevation is 11.46 feet above the zero of the gage. The station was discontinued September 9, 1903, on account of its being affected by the dam at Cloquet and on account of poor conditions for obtaining accurate measurements.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following discharge measurement was made by W. C. Hoag in 1903:

July 1: Gage height, 1.39 feet; discharge, 631 second-feet.

Mean daily gage height, in feet, of St. Louis River near Cloquet, Minn., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	4.50	1.40	(a)	1.90	17	.....	2.20	1.30	1.50	.....
2	.....	4.20	1.30	(a)	1.70	18	.....	2.10	1.30	1.45	.....
3	.....	4.20	1.80	(a)	1.70	19	.....	2.00	.....	1.45	.....
4	.....	3.80	1.70	(a)	1.55	20	.....	1.80	1.40	2.10	.....
5	.....	3.60	.....	(a)	1.45	21	.....	.....	1.30	2.20	.....
6	.....	3.00	1.60	(a)	.....	22	.....	1.60	1.50	2.25	.....
7	.....	.....	1.60	(a)	.....	23	.....	1.40	1.50	.....	.....
8	.....	2.80	1.70	(a)	.....	24	.....	1.40	1.50	2.00	.....
9	.....	2.80	1.80	(a)	.....	25	.....	1.30	1.80	2.00	.....
10	.....	3.00	1.80	1.50	.....	26	.....	1.20	.....	1.65	.....
11	.....	2.60	1.90	1.55	.....	27	4.80	1.20	.....	1.60	.....
12	.....	2.40	.....	1.50	.....	28	4.80	.....	.....	1.60	.....
13	.....	2.40	1.80	1.45	.....	29	4.70	1.30	.....	2.00	.....
14	.....	.....	1.70	1.50	.....	30	4.80	1.20	.....	.....	.....
15	.....	2.20	1.50	1.45	.....	31	.....	.....	.....	1.85	.....
16	.....	2.20	1.40	.....	.....						

[a] Observer left.

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Reference.

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DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1903

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

JOHN C. HOYT

PART II.—Southern Atlantic, Eastern Gulf of Mexico, and Eastern Mississippi River Drainage

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
Washington, D. C., March 23, 1904.

SIR: I have the honor to transmit herewith Water-Supply Paper No. 98, which is Part II of a series of four papers numbered 97 to 100, inclusive. These papers compose the Report of Progress of Stream Measurements for the calendar year 1903. Parts I and II of this report contain the results of the data collected from the territory east of the Mississippi River. Parts III and IV are devoted to the data collected in the territory west of the Mississippi River.

The work of assembling the data on which this report is based and also the preparation of the same for publication has been under the immediate direction of John C. Hoyt, who has been assisted by Frank H. Brundage, L. R. Stockman, R. H. Bolster, H. J. Saunders, and W. A. Brothers. Special acknowledgment is due Maxcy R. Hull, district hydrographer for the Southern States, under whose supervision the larger part of the data given were collected, for suggestions and help in their preparation.

Very respectfully,

F. H. NEWELL,
Chief Engineer.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1903.

PART II.

By JOHN C. HOYT.

INTRODUCTION.

During the calendar year 1903 the work of measuring the flow of streams has been continued on the same general lines as in previous years. During 1903 special efforts have been made to collect such other information as will be of use in general hydrographic studies. Reconnaissances have been made on many of the important rivers in different portions of the United States, and much valuable data collected in regard to floods, water powers, river profiles, etc.

During 1903 the number of regular stations at which stream measurements are being made has been steadily increased, so that at the close of the year systematic measurements were being carried on at approximately five hundred points. The stations are distributed so as to best cover the needs of the various States and Territories. The location of principal gaging stations is shown on Plate I. This expansion of the work is the result of the constantly increasing demand from engineers and the general public for the stream data collected by the Survey. The requests for information have been so numerous that the supply of publications containing the results has in many cases become exhausted.

The Survey has continued to receive the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the publication of many valuable records which could not otherwise have been obtained.

The Report of Progress of Stream Measurements for the calendar year 1903, of which this is Part II, is published in a series of four Water-Supply Papers, Nos. 97–100, inclusive, under the following subtitles:

Part I. Northern Atlantic and Great Lakes Drainage.

Part II. Southern Atlantic, Eastern Gulf of Mexico, and Eastern Mississippi River Drainage.

Part III. Western Mississippi River and Western Gulf of Mexico Drainage.

Part IV. Interior Basin, Pacific, and Hudson Bay Drainage.

The territory covered by each paper is given in the subtitle and the larger drainages are, for convenience in arrangement, subdivided into smaller ones under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon these observations and other information that may be of use in hydrographic studies, including, as far as available, a description of the drainage area.

For each regular station are given, as far as available, the following data:

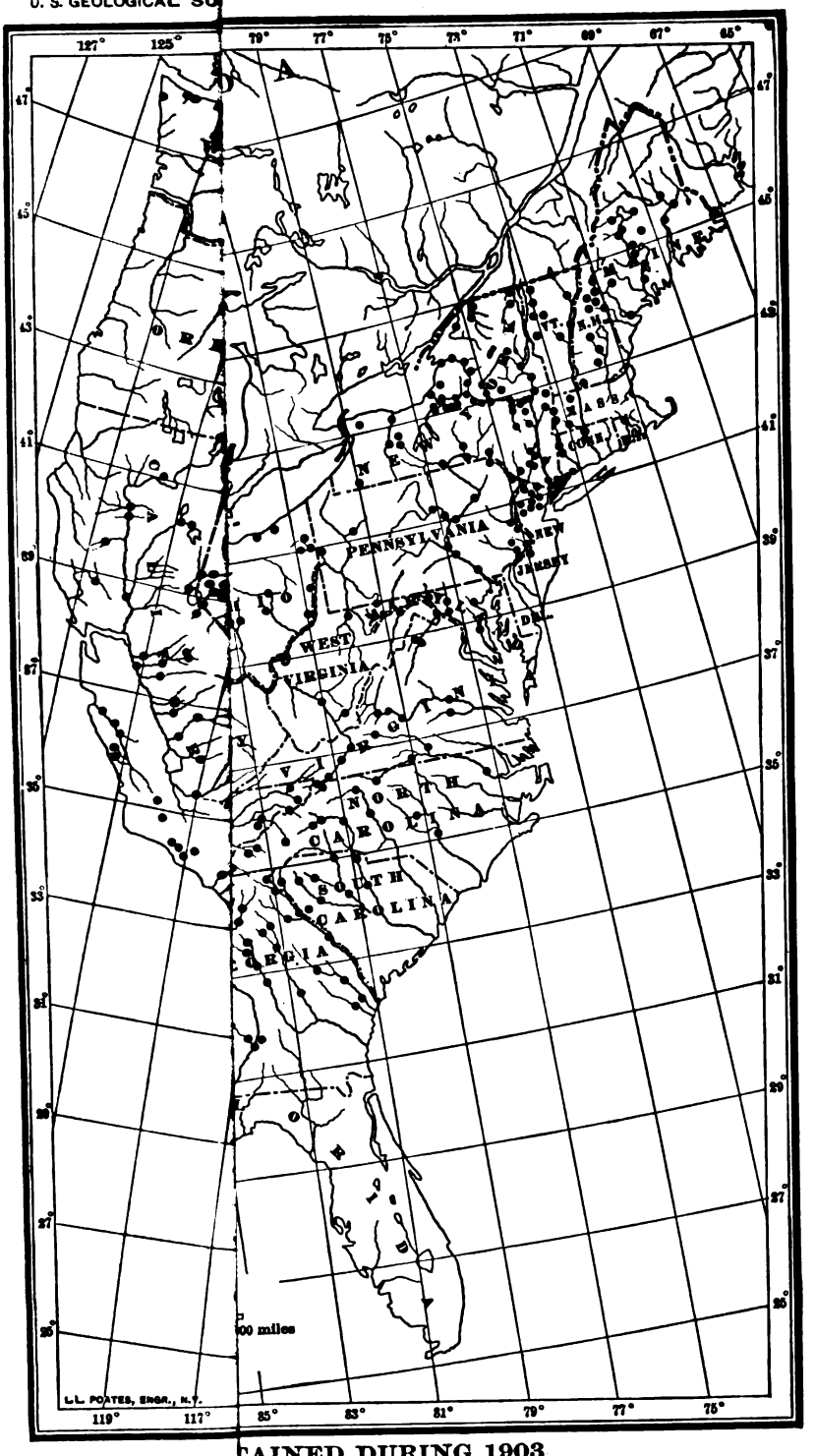
1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and make use of the equipment. The report also contains, as far as possible, a complete history of all the changes which have occurred since the establishment of the station and which affect the use of the data collected.

The discharge-measurement tables give the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the fluctuations of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and evening.

The rating table gives discharges in second-feet corresponding to each stage of the river, as given by the gage heights. It depends upon the general law that for streams of practically constant cross section the discharge is a function of the gage height, and that like gage heights will have the same discharge. In its preparation the discharge measurements are plotted on cross-section paper to some convenient scale, using gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which is the basis for the table. From this curve are tabulated, on forms prepared for the purpose, the discharges corresponding to each tenth of a foot on the gage. The first and second differences between the successive discharges are then taken. These are adjusted on the assumption that there is a gradual increase in the discharge as the gage height increases, and the discharge values in the table are then



TAINED DURING 1903

adjusted according to these revised differences. In preparing the rating table all available data are brought into use, including special conditions which might affect the discharge. For high waters above the stage covered by discharge measurements the general rule is to extend the curve by a tangent line. In case the river overflows its banks a percentage of the discharge is added, depending on the depth and velocity of the overflowed portion. For stages below that portion of the curve which is fixed by discharge measurements the curve has been extended, following the general form of the determined lower portion. Notes under each rating table indicate those portions that are based on actual observation and those that are estimated.

From the rating table and daily gage heights a table giving the daily discharge of the streams is prepared. From this the table of estimated monthly and yearly discharges and run-off is computed. This latter table gives in condensed form a summary of the results obtained from the observations made during the year at the station. In order to explain this table, the following definitions are given:

The term "second-feet" is an abreviation for "cubic feet per second." It is the number of cubic feet of water flowing by the gaging station every second. The column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, as given in the rating table for that mean gage height. As the gage height is the mean for the day there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the two remaining columns in the table are based.

The expression "second-feet per square mile" means the number of cubic feet of water flowing from every square mile of drainage area for each second.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall.

It should be noticed that "depth in inches" represents the actual quantity of water produced during the period in question, while "second-feet" is merely a rate of flow into which the element of time does not enter.

The results of the stream measurements and other hydrographic work performed during previous years by the United States Geological Survey can be found in the following Survey publications:

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.

1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131, and Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11, Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16, Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28, Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive, Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47 to 52, inclusive, Twenty-second Annual Report, Part IV.
1901. Water-Supply Papers Nos. 65, 66, and 75.
1902. Water-Supply Papers Nos. 82 to 85, inclusive.
1903. Water-Supply Papers Nos. 97 to 100, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director United States Geological Survey. Aside from these, other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at a nominal price. Copies of Government publications are, as a rule, furnished to public libraries in the large cities, where they may be consulted.

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Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Alabama: District hydrographer, M. R. Hall, assisted by J. M. Giles. Dr. E. A. Smith, State geologist, has paid the salaries of the river observers at Riverside, Nottingham, Jenifer, Sturdevant, Alexander, and Centerville. Gage heights were furnished by R. C. McCalla, United States engineer, for the stations at Tuscaloosa, Cordova, and Palos, and by the United States Weather Bureau official, F. P. Chaffee, for Selma.

Georgia: District hydrographer, M. R. Hall, assisted by J. M. Giles, O. P. Hall, F. A. Murray, and W. E. Hall. Prof. W. S. Yeates, State geologist, has paid the salaries of the river observers at Millen, Groveland, Davisboro, Reidsville, Milledgeville, Greensboro, Buckhead, Flovilla, Lithonia, Covington, Norcross, Gainesville, Albany (Muckalee Creek), Albany (Kinchafoone Creek), Rome (Etowah), Canton, Carters, and Blue Ridge. J. M. Youngblood has furnished, without cost, gage heights for Augusta. The following Weather Bureau officials have furnished gage heights for the Weather Bureau stations, as noted in the

descriptions of stations: D. Fisher, Augusta, Ga.; J. B. Marbury, Atlanta, Ga.; J. R. Weeks, Macon, Ga., and F. P. Chaffee, Montgomery, Ala. Transportation has been furnished by J. S. B. Thompson, general agent of the Southern Railway; by E. Berkley, superintendent of the third division of the Seaboard Air Line Railway; by Thomas K. Scott, general manager of the Georgia Railroad; by James T. Wright, vice-president and general manager of the Macon, Dublin and Savannah Railroad; by John M. Eagan, president of the Central of Georgia Railway; by J. H. Ellis, vice-president and general manager of the Atlanta, Knoxville and Northern Railway; by C. A. Wickersham, president and general manager Atlanta and West Point Railroad and Western Railway of Alabama. The above transportation was not confined to the State of Georgia, but was furnished also for the States of South Carolina, Alabama, Mississippi, and Tennessee.

Illinois: District hydrographer, E. Johnson, jr., assisted by E. H. Heilbron, assistant engineer sanitary district of Chicago.

Indiana: District hydrographer, E. Johnson, jr., assisted by F. W. Hanna, assistant engineer; H. C. Lootz, assistant engineer; George E. Waesche, of the engineering department of Purdue University. Acknowledgment should also be made to Joseph M. Steiner and O. H. Griest, who have assisted the Survey in establishing and supplying voluntary reading at Cataract and Shoals, Ind., respectively.

Minnesota: District hydrographer, E. Johnson, jr., assisted by L. R. Stockman, assistant engineer, and W. R. Hoag, of the engineering department of the University of Minnesota.

North Carolina: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by B. S. Drane and O. P. Hall.

South Carolina: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by B. S. Drane, J. M. Giles, F. A. Murray, and W. E. Hall.

Ohio: District hydrographer, E. Johnson, jr., assisted by Benjamin H. Flinn, C. L. Bushey, and R. W. Pratt, engineer State board of health. Acknowledgment should also be made to Dr. C. O. Probst, secretary State board of health, Ohio, for assistance rendered, and to the Baltimore and Ohio Railroad for passes issued to E. Johnson, jr., and R. W. Pratt.

Tennessee: District hydrographer, M. R. Hall (and E. W. Myers for a part of the year), assisted by J. M. Giles, O. P. Hall, and B. S. Drane. Gage heights for stations at Chattanooga, Knoxville, and Nashville were furnished by the United States Weather Bureau officials, L. M. Pindell, Chattanooga, and H. C. Bate, Nashville.

Wisconsin: District hydrographer, E. Johnson, jr., assisted by L. R. Stockman, assistant engineer. Acknowledgment should also be made to Prof. L. S. Smith, of the engineering department of the University of Wisconsin, for material assistance rendered.

SOUTHERN ATLANTIC COAST DRAINAGE.

Systematic measurements of discharge of many of the larger rivers of the southern Atlantic States have been made during the year. The drainage areas of the rivers in that region are in general similar. Most of the streams rise in the southern Appalachian Mountains or their foothills. In the upper part of their courses they are rapid, with considerable fall. Across the Piedmont Plain their valleys are wide and

their flow in general is sluggish, with occasional falls over rocky beds. Many of them have falls that could be utilized for water power, and it is largely to that end that data of the flow are being collected. In the study of water power it is important to know the flow and the fall. The fall can readily be determined by an engineer, but the variations in flow often require long and careful study. Gaging stations, to determine the latter, have been established on nearly all the larger streams in the region, and it is hoped that in the near future our information of their fall will be extended.

In this report the drainage areas in this section from which data have been received during 1903 have been grouped as follows, and arranged geographically from north to south:

Roanoke, Cape Fear, Pedee or Yadkin, Santee, Savannah, Ogeechee, and Altamaha river basins.

ROANOKE RIVER DRAINAGE BASIN.

Roanoke River drains a total area of about 9,200 square miles and empties into Albemarle Sound a short distance below Plymouth, N. C. It is navigable at all stages for 120 miles to Weldon, N. C., where the river crosses the fall line.

The Roanoke proper is formed by the confluence of the Dan and Staunton rivers, at Clarksville, Mecklenburg County, Va., 185 miles above the mouth of the stream, though the name "Roanoke" is also applied to the upper waters of Staunton River. These streams drain, respectively, 3,798 and 3,546 square miles. The United States Weather Bureau maintains a gage at Clarksville, and gaging stations on both streams were also maintained here by the Geological Survey for some years.

Of these streams the Staunton is the more northerly, its drainage basin lying entirely in Virginia. It rises among the eastern foothills of the Blue Ridge southwest of Roanoke and Salem, being known in this part of its course as the Roanoke, and flows at first northeast, then southeast through Montgomery, Roanoke, Bedford, Campbell, Halifax, and Mecklenburg counties to the junction with the Dan.

A large part of the area drained by the Dan lies in North Carolina. The stream rises in Surry County, N. C., and in Patrick County, Va., and flows at first southeast, through Stokes County, N. C., then northeast through Rockingham and Caswell counties, N. C., and through Pittsylvania, Halifax, and Mecklenburg counties, Va., to the junction with the Staunton.

The average rainfall on the basin of the Roanoke above the fall line is about 48 inches per annum. The average amount probably increases slightly as the stream is ascended, though the records of rainfall over the basin are too incomplete to decide this matter. The amount of rainfall is evenly distributed throughout the year. This results in a

variable flow, since it is probable that the evaporation is comparatively large.

The freshets on the river are violent, and the fluctuations of height occur with great rapidity. Rises of 50 feet and over have been noted at Weldon, and freshets in which the rate of rise is 10 feet a day or more are frequent.

Gaging stations were maintained by the United States Geological Survey during 1903 on the Roanoke River proper at Neal, near Kelford, N. C.; on the Roanoke (upper portion of the Staunton) at Roanoke, Va.; on the Dan at South Boston, Va., and at Madison, N. C., and on the Staunton at Randolph, Va.

ROANOKE RIVER AT NEAL, N. C.

This station was established on July 27, 1896. It is located at the Norfolk and Carolina Railroad bridge at Neal, near Kelford, N. C.

The zero of the gage rod is over the center of the fourth floor beam of the second span from the north end of the bridge. The distance from the zero of the rod to the outer rim of the pulley is 2.47 feet, and the distance from the end of the weight to the pointer on the wire is 44.66 feet.

The section is a fairly good one, the course of the river being straight for some distance above and below the station and the bottom smooth. Being muddy, however, the bed is apt to cut out in seasons of high water, and both banks are subject to overflow. The observer was the bridge watchman, W. M. Adams, of Neal, N. C. The station was discontinued May 31, 1903.

The observations at this station during 1903 have been made under the direction of E. W. Myers, district hydrographer.

Mean daily gage height, in feet, of Roanoke River at Neal, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	9.20	17.30	18.40	24.80	20.90	17	12.30	19.90	17.00	24.65	9.00
2	9.30	16.40	22.40	25.25	18.80	18	11.25	23.50	15.70	24.10	8.75
3	9.30	14.60	23.50	25.35	17.00	19	11.25	29.20	14.60	22.60	8.50
4	21.25	13.30	23.70	24.45	15.50	20	10.65	25.60	13.70	20.70	8.30
5	23.55	12.10	22.20	23.50	14.30	21	9.95	29.30	13.00	19.00	8.05
6	25.00	21.90	20.10	22.80	13.80	22	9.70	27.80	15.10	18.70	7.90
7	26.55	23.15	18.10	21.90	13.20	23	13.10	25.90	23.05	18.70	7.70
8	26.60	23.20	16.70	20.40	12.50	24	17.40	23.60	25.15	21.10	7.50
9	24.80	22.50	16.50	21.30	11.80	25	16.50	21.20	29.30	21.20	7.55
10	22.50	22.20	16.40	23.05	11.35	26	14.90	19.00	30.35	20.40	7.85
11	19.90	21.80	17.20	24.00	10.80	27	13.30	17.20	30.20	20.70	8.00
12	17.60	21.10	17.90	24.25	10.30	28	12.10	15.70	29.05	22.10	8.50
13	17.50	21.90	18.22	23.30	9.95	29	11.60	.....	26.60	22.45	9.70
14	16.80	23.70	18.65	21.60	9.60	30	17.40	.....	24.80	22.30	10.80
15	15.40	21.80	18.65	23.45	9.40	31	20.00	.....	24.40	.....	.....
16	13.50	20.60	18.20	24.35	9.20						

Rating table for Roanoke River at Neal, N. C., from January 1 to May 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
7.5	6,705	11.5	10,955	15.5	16,180	23.0	35,500
8.0	7,200	12.0	11,530	16.0	16,930	24.0	41,000
8.5	7,700	12.5	12,130	17.0	18,530	25.0	46,500
9.0	8,200	13.0	12,730	18.0	20,280	26.0	52,195
9.5	8,730	13.5	13,380	19.0	22,130	27.0	59,000
10.0	9,280	14.0	14,030	20.0	24,230	28.0	66,500
10.5	9,830	14.5	14,730	21.0	26,630	29.0	74,000
11.0	10,380	15.0	15,430	22.0	30,000	30.0	82,000

Rating table for 1903 same as that for 1902.

Estimated monthly discharge of Roanoke River at Neal, N. C., for 1903.

[Drainage area, 8,717 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	56,277	8,412	20,798	2.39	2.76
February	76,400	11,650	33,081	3.79	3.95
March	84,800	12,730	32,985	3.78	4.36
April	48,493	21,575	33,880	3.89	4.34
May 1–30	26,390	6,705	10,676	1.22	1.36

DAN RIVER AT MADISON, N. C.

This station was established May 14, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at the Southern Railway bridge about one-fourth mile from Madison and one-half mile above the mouth of Mayo River. The standard chain gage with inclosed scale is located on the upstream side of the bridge in the sixth panel of the first span from the left end. The length of the chain from the weight to the marker is 35.24 feet. During 1903 the gage was read once each day by J. W. Ward. Discharge measurements are made from the upstream side of the covered wooden two-span railway bridge and its wooden approaches. The initial point for soundings is the end of the guard rail of the trestle over the left bank. Distances are measured along the upstream guard rail and are marked with white paint. Above the station the channel is straight for about 600 feet and the current velocity is good. About 300 feet below the station the channel makes an abrupt turn. The right bank is low and overflows. There is a long trestle approach to the bridge on this side, and all water

passes beneath the bridge and approaches. The left bank is low and overflows. There is a small stream entering from this side. The bed of the stream is sandy and probably permanent. There is but one channel at all stages. Bench mark No. 1 is the edge of the top of a large wire nail driven flush into the top corner of the wooden floor beam, which is beneath gage datum on the upstream side of the bridge. The point is indicated by the letters "B. M." in white paint. When the gage reads zero, the water surface is 34.10 feet below this bench mark. Bench mark No. 2 is a standard iron bench-mark post set in cleared level ground on the left or south side of the railway track. It is 77 feet west of the initial point for soundings, and 9 feet south of the south rail of the track. Its elevation above the water surface when the gage reads zero is 36.21 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Dan River at Madison, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 14	E. W. Myers	2.05	950
Do	do	2.07	1,002
June 18	do	2.05	731
Do	do	2.05	742
July 18	B. S. Drane	1.17	683
Do	do	1.14	626
August 26	do	1.16	527
October 1	do	.86	367
Do	do	.86	396
November 18	do	2.31	817
December 21	do	2.07	748

Mean daily gage height, in feet, of Dan River at Madison, N. C., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.95	2.00	8.35	1.30	0.95	0.85	0.70
2		2.70	1.85	2.35	1.15	.85	.85	1.00
3		2.55	1.75	1.85	1.10	.85	.90	.70
4		2.20	1.70	1.80	1.05	.85	.85	.85
5		4.00	2.50	1.70	1.00	.85	2.80	1.05
6		3.60	3.15	3.35	1.00	.90	1.50	.90
7	17.25	17.00	2.75	1.70	.90	.85	1.00	.70
8	4.80	4.80	1.80	1.35	.90	2.00	.95	.90
9	4.20	4.20	1.65	1.30	4.65	2.30	.90	.95
10	5.65	5.65	1.60	1.30	1.30	1.10	.95	.90
11	3.45	3.45	1.65	1.70	1.10	.95	.90	.75
12	3.00	3.00	1.75	1.75	1.10	.90	.95	1.00
13	2.55	2.55	6.10	1.10	1.00	.90	.90	1.15

Mean daily gage height, in feet, of Dan River, etc.—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14	.....	2.40	3.75	1.30	0.90	0.85	0.90	1.10
15	2.00	2.35	2.25	6.60	.90	.85	.85	1.00
16	1.95	2.20	1.80	2.35	.90	.95	.85	.70
17	1.95	2.10	1.70	1.80	5.70	1.10	1.30	.85
18	1.90	2.05	1.65	8.60	2.65	2.05	2.50	.55
19	1.90	2.00	1.60	2.50	1.50	1.25	1.50	.75
20	1.80	3.65	1.60	1.85	1.20	1.00	1.10	1.00
21	1.90	2.35	1.40	1.75	1.15	1.00	1.00	2.25
22	1.75	2.00	1.35	1.70	1.10	.90	1.05	1.35
23	1.70	3.90	2.00	1.60	1.05	.90	.95	1.15
24	1.60	2.10	1.40	1.30	1.05	.95	1.00	1.10
25	1.80	2.00	1.25	1.25	1.00	.85	.95	1.15
26	2.00	3.85	1.25	1.15	.95	.80	.95	1.45
27	1.90	7.05	1.20	1.20	.95	.80	.80	1.20
28	3.00	2.80	1.10	1.10	1.00	.80	.75	1.10
29	4.10	2.75	2.50	1.05	.95	.85	.90	1.00
30	2.75	2.20	2.15	2.00	.90	.85	.90	.85
31	2.65	.....	2.00	1.30	.....	.80	.....	.75

DAN RIVER AT SOUTH BOSTON, VA.

This station, which was established on August 27, 1900, by E. W. Myers, is in the town of South Boston, Va., on the railroad bridge of the Norfolk and Western Railroad, which crosses the river at that place. On May 18, 1903, B. S. Drane replaced the wire gage with a standard chain gage. The datum was not changed. The gage is located on the downstream guard rail near the center of the first span from the left bank. The length of the chain from the end of the weight to the marker is 35.02 feet. The observer is J. Mercer East. Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is the left end of the downstream guard rail. This is a very good station for the gaging of all except the very highest stages of flow. At extreme heights the river spreads out over a flood plain of considerable width. The trestle connecting the bridge with the embankment on the south side of the river is a curve of rather high degree. The bed of the stream is of coarse sand and probably shifts only slightly.

Bench mark No. 1 is the sharp inner corner toward the left bank of the plate attached to the inner surface of the struts at the center of the left span and to the bearing of the wooden floor beam and tie. The elevation of the top of the plate is 32.86 feet above gage datum.

Bench mark No. 2 is the top of a standard copper bolt set in the capstone of the abutment of the viaduct by means of which the Southern Railway crosses the highway a short distance upstream from the Norfolk and Western and Southern Railway crossing. Its elevation is 30.65 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Dan River at South Boston, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 18	B. S. Drane	22.45	43,036
March 27	E. C. Murphy	8.10	7,393
May 18	E. W. Myers	3.01	2,959
May 19	do	2.94	2,801
June 23	do	3.59	3,044
Do	do	3.67	3,136
August 8	B. S. Drane	2.62	2,378
August 27	do	1.39	1,401
Do	do	1.44	1,389
September 18	do	8.78	9,411
September 25	Paul and Sawyer	1.40	1,519
December 2	W. C. Sawyer	1.51	1,258

Mean daily gage height, in feet, of Dan River at South Boston, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	3.90	8.20	11.65	5.20	7.40	6.65	1.90	(a)	1.32	1.35	1.65
2	4.25	3.90	7.75	7.95	5.15	6.20	5.00	2.30	2.00	1.22	1.42	1.60
3	12.05	3.90	6.35	7.15	4.80	4.30	3.50	2.60	(a)	1.20	1.40	1.62
4	18.80	5.45	5.65	7.75	4.50	3.90	3.10	2.90	(a)	1.10	1.60	1.65
5	15.55	[b] 15.95	5.15	8.10	4.50	3.90	7.25	4.45	(a)	1.20	2.90	1.67
6	9.10	11.70	4.95	6.90	4.50	4.85	12.45	4.30	(a)	1.22	3.40	1.62
7	6.90	8.85	4.90	6.10	4.50	8.30	14.00	4.50	(a)	1.30	2.75	1.62
8	5.90	8.25	4.90	12.45	4.30	14.55	9.35	2.60	(a)	1.65	1.90	1.48
9	5.25	7.25	5.15	[c] 16.80	4.30	7.20	3.75	2.40	(a)	3.15	1.72	1.38
10	4.95	6.75	5.35	13.95	4.30	5.75	2.50	2.30	(a)	3.85	1.70	1.45
11	4.70	6.85	6.05	9.05	4.15	11.30	2.40	2.20	(a)	1.90	1.65	1.58
12	5.10	14.20	8.05	6.90	3.88	12.55	2.40	2.80	(a)	1.45	1.55	1.65
13	5.00	10.40	8.50	6.55	3.85	5.75	6.30	2.50	(a)	1.40	1.48	1.67
14	4.80	6.90	7.35	6.90	3.80	4.05	12.40	2.50	1.50	1.35	1.45	1.70
15	4.70	6.10	6.60	7.10	3.80	3.50	8.90	2.95	(a)	1.32	1.57	1.67
16	4.50	5.55	5.90	7.10	3.80	3.35	4.75	3.20	(a)	1.28	1.55	1.67
17	4.40	18.35	5.20	6.90	3.80	3.15	2.85	3.40	(a)	1.42	1.42	1.67
18	4.40	[d] 22.00	4.70	6.50	3.80	2.85	2.70	4.30	8.40	1.70	3.60	1.67
19	4.40	19.20	4.30	6.50	3.35	6.00	2.60	7.05	4.10	2.42	4.47	1.65
20	4.40	12.30	4.20	6.40	2.95	9.17	2.55	(a)	2.35	2.15	2.30	1.70
21	4.50	6.55	4.65	6.30	2.90	9.05	2.50	(a)	1.85	1.65	1.72	1.67
22	4.85	5.55	15.45	6.30	2.90	5.95	2.25	(a)	1.70	1.18	1.72	1.57
23	4.65	5.25	21.05	6.30	2.80	4.30	1.95	(a)	1.60	1.50	1.72	1.52
24	4.45	4.85	23.15	6.30	2.75	3.70	1.90	(a)	1.45	1.40	1.55	1.55
25	4.20	4.70	21.70	6.30	2.95	3.20	1.80	(a)	1.38	1.35	1.58	1.40
26	4.20	4.45	11.70	6.30	3.10	2.85	1.70	(a)	1.35	1.48	1.57	1.40
27	4.20	4.30	7.85	9.80	3.30	2.70	1.60	1.40	1.35	1.52	1.58	1.55
28	4.10	4.65	6.40	8.70	4.70	2.60	1.60	(a)	1.35	1.45	1.58	6.95
29	4.10	.....	5.80	7.15	8.20	5.67	1.50	(a)	1.35	1.42	1.62	5.00
30	4.00	.....	11.00	5.45	9.25	7.75	1.55	(a)	1.35	1.30	1.72	2.00
31	4.00	.....	12.05	.....	9.30	.....	1.90	(a)	.....	1.48	.....	1.62

[a] No record.
[b] Highest record, 16.2 at 10 a. m.
[c] Highest record, 17.7 at 4 p. m.
[d] Highest record, 22.5 at 4 p. m.

Rating table for Dan River at South Boston, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.1	1,185	3.6	3,240	8.2	8,110	13.2	15,260
1.2	1,250	3.7	3,330	8.4	8,350	13.4	15,610
1.3	1,320	3.8	3,420	8.6	8,610	13.6	15,970
1.4	1,390	3.9	3,510	8.8	8,870	13.8	16,330
1.5	1,465	4.0	3,600	9.0	9,130	14.0	16,700
1.6	1,540	4.2	3,800	9.2	9,390	14.2	17,080
1.7	1,620	4.4	4,000	9.4	9,650	14.4	17,460
1.8	1,700	4.6	4,200	9.6	9,910	14.6	17,850
1.9	1,780	4.8	4,400	9.8	10,170	14.8	18,250
2.0	1,860	5.0	4,600	10.0	10,430	15.0	18,650
2.1	1,940	5.2	4,800	10.2	10,690	15.2	19,060
2.2	2,020	5.4	5,000	10.4	10,960	15.4	19,480
2.3	2,100	5.6	5,200	10.6	11,240	15.6	19,910
2.4	2,180	5.8	5,400	10.8	11,520	15.8	20,350
2.5	2,265	6.0	5,600	11.0	11,800	16.0	20,790
2.6	2,350	6.2	5,810	11.2	12,100	16.5	21,950
2.7	2,435	6.4	6,030	11.4	12,400	17.0	23,170
2.8	2,520	6.6	6,250	11.6	12,700	17.5	24,450
2.9	2,610	6.8	6,470	11.8	13,000	18.0	25,840
3.0	2,700	7.0	6,690	12.0	13,300	18.5	27,320
3.1	2,790	7.2	6,910	12.2	13,620	19.0	28,860
3.2	2,880	7.4	7,150	12.4	13,940	19.5	30,460
3.3	2,970	7.6	7,390	12.6	14,260	20.0	32,130
3.4	3,060	7.8	7,630	12.8	14,580	20.5	33,890
3.5	3,150	8.0	7,870	13.0	14,920	21.0	35,800

Tangent above 21 feet gage height. Differences above this point, 400 per tenth. Table well determined to 10 feet gage height. Above this point it is approximate.

Estimated monthly discharge of Dan River at South Boston, Va., for 1903.

[Drainage area, 2,750 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	28,240	2,700	5,934	2.16	2.49
February	39,800	3,510	9,953	3.62	3.78
March	44,400	3,800	10,084	3.67	4.23
April	22,670	5,050	8,065	2.93	3.27
May	9,520	2,475	4,050	1.47	1.69
June	17,750	2,350	5,785	2.10	2.34
July	16,700	1,465	4,389	1.60	1.84
August (1-19 and 27)[a]			2,861	1.04	.77
September (15 days)[a]			2,133	.78	.44
October	3,465	1,185	1,551	.56	.65
November	4,070	1,355	1,811	.66	.74
December	6,635	1,376	1,811	.66	.76

[a] No record for missing days.

STAUNTON RIVER AT RANDOLPH, VA.

This station was originally established August 27, 1900, by E. W. Myers. It is located on the railroad bridge about five-eighths of a mile southwest of the Southern Railway station at Randolph, Va. The present gage was installed by B. S. Drane May 20, 1903. It is a standard chain gage and occupies practically the same position as the wire gage which it replaced. It is attached to the upstream guard rail in the middle of the second span from the left bank. The datum is the same as that of the original gage. The length of the chain from the end of the weight to the marker is 43.13 feet. The observer is J. E. Figg, the station agent. Discharge measurements are made from the bridge to which the gage is attached. The current is moderately rapid and has a well-distributed velocity. The channel is straight for a considerable distance above and below the station and has a width at ordinary stages of about 400 feet, broken by one bridge pier. The bed is composed mainly of firm material and is permanent. The bridge makes a small angle with the normal to the direction of the current. Bench mark No. 1 is the top of the floor beam nearest the zero of the gage scale at a point 0.2 foot downstream from the adjacent tie. Its elevation is 42.01 feet above the gage datum. Bench mark No. 2 is a copper bolt set in the capstone on the downstream side of the left abutment about 3 feet from the end of the ties. Its elevation is 36.99 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Staunton River at Randolph, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 25	B. S. Drane	24.20	24,730
March 27	E. C. Murphy	10.45	7,877
May 20	E. W. Myers	5.19	3,095
June 24	do	5.32	2,520
Do	do	5.29	2,490
August 8	B. S. Drane	4.59	2,220
August 28	do	3.62	1,451
Do	do	3.61	1,468
September 25	Paul and Sawyer	4.20	1,877
December 3	W. C. Sawyer	3.82	1,466

Mean daily gage height, in feet, of Staunton River at Randolph, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.10	7.70	18.80	15.70	7.40	6.60	7.90	4.40	10.60	4.10	4.10	3.80
2	5.60	6.90	12.30	11.30	7.00	6.40	6.80	4.70	9.10	3.90	4.30	3.90
3	19.90	6.55	9.20	9.70	7.00	6.10	6.30	5.10	5.70	3.80	4.20	3.80
4	18.00	10.70	8.60	10.90	7.00	5.90	5.90	5.30	4.50	3.70	4.50	3.90
5	16.00	13.60	7.80	10.20	6.90	6.40	5.70	5.10	4.30	3.90	4.80	4.10
6	11.20	11.10	7.50	8.90	6.70	6.80	5.50	4.90	4.40	4.20	5.00	4.00
7	9.10	8.30	7.80	8.40	6.50	8.90	5.60	4.70	4.60	4.80	4.90	4.20
8	8.20	8.10	7.90	13.00	6.40	11.10	5.30	4.50	4.50	6.60	4.60	4.10
9	7.20	8.10	9.40	13.40	6.10	7.60	5.00	4.30	4.40	7.30	4.40	4.40
10	6.60	7.50	10.20	11.50	6.10	8.40	4.70	4.40	4.20	6.40	4.10	4.20
11	7.80	7.70	9.00	9.10	6.00	9.40	4.40	4.20	4.30	5.60	3.90	4.00
12	7.60	13.00	9.40	8.30	6.00	6.90	4.60	4.30	3.80	5.30	3.80	4.10
13	6.70	11.00	9.70	9.60	5.90	5.60	4.70	4.40	4.30	4.90	3.70	3.90
14	6.00	8.80	9.40	13.20	5.90	5.80	5.20	4.30	4.60	4.70	3.90	4.20
15	5.70	8.00	8.60	12.80	5.80	5.70	5.40	4.20	5.40	4.90	4.10	4.10
16	5.80	8.40	8.00	11.90	5.60	5.40	5.30	4.60	7.80	5.10	4.20	3.80
17	5.80	22.60	7.60	9.80	5.50	5.50	5.00	5.00	8.50	4.80	4.00	4.20
18	5.80	26.20	7.20	8.90	5.40	5.40	5.10	5.50	15.30	4.70	3.90	4.40
19	5.55	16.80	6.90	7.40	5.30	5.10	4.70	6.30	7.90	4.60	3.80	4.60
20	5.20	10.10	6.75	7.50	5.20	4.90	4.20	5.90	6.80	4.40	3.90	4.80
21	7.10	8.90	9.40	7.35	5.10	5.00	4.30	5.60	6.30	4.30	4.00	4.60
22	10.70	8.40	21.80	7.20	5.20	5.20	4.50	5.20	6.10	4.20	4.10	4.50
23	9.60	7.80	24.00	7.40	5.30	5.00	4.40	4.90	5.40	4.00	4.20	4.60
24	7.50	7.40	26.30	7.50	5.50	5.10	4.20	4.80	4.90	3.90	4.40	4.80
25	6.70	7.10	22.80	7.70	5.80	5.20	4.00	4.50	4.20	4.10	4.20	4.90
26	6.30	6.80	12.90	7.90	5.70	6.40	3.90	4.10	4.00	4.20	4.10	4.70
27	6.00	6.50	10.20	9.00	5.90	8.10	3.70	3.80	4.50	4.10	4.20	4.60
28	10.30	11.00	9.40	11.45	6.20	11.90	3.80	3.40	4.60	4.20	3.90	4.40
29	13.40	.....	8.60	9.80	6.40	10.50	3.90	3.70	4.30	4.00	3.80	4.50
30	10.00	.....	13.40	8.60	6.50	9.60	4.00	12.30	4.00	3.90	3.70	4.30
31	8.60	.....	19.30	.....	6.80	.....	4.20	11.40	.....	3.80	.....	4.40

Rating table for Staunton River at Randolph, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.4	1,310	5.4	2,830	7.8	4,860	11.8	9,080
3.5	1,370	5.5	2,910	8.0	5,040	12.0	9,320
3.6	1,435	5.6	2,990	8.2	5,240	12.2	9,560
3.7	1,500	5.7	3,070	8.4	5,440	12.4	9,800
3.8	1,570	5.8	3,150	8.6	5,640	12.6	10,040
3.9	1,640	5.9	3,230	8.8	5,840	12.8	10,280
4.0	1,715	6.0	3,310	9.0	6,040	13.0	10,520
4.1	1,790	6.1	3,390	9.2	6,240	13.2	10,760
4.2	1,870	6.2	3,470	9.4	6,440	13.4	11,000
4.3	1,950	6.3	3,550	9.6	6,640	13.6	11,240
4.4	2,030	6.4	3,630	9.8	6,840	13.8	11,480
4.5	2,110	6.5	3,710	10.0	7,060	14.0	11,720
4.6	2,190	6.6	3,790	10.2	7,280	14.2	11,960
4.7	2,270	6.7	3,870	10.4	7,500	14.4	12,200
4.8	2,350	6.8	3,960	10.6	7,720	14.6	12,460
4.9	2,430	6.9	4,050	10.8	7,940	14.8	12,720
5.0	2,510	7.0	4,140	11.0	8,160	15.0	12,980
5.1	2,590	7.2	4,320	11.2	8,380	15.5	13,680
5.2	2,670	7.4	4,500	11.4	8,600	16.0	14,400
5.3	2,750	7.6	4,680	11.6	8,840		

Tangent above 15.8 feet, gage height; differences above this point, 150 per tenth. Table above 12 feet gage height is a rough approximation.

Estimated monthly discharge of Staunton River at Randolph, Va., for 1903.

[Drainage area, 3,076 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	20,250	2,590	5,964	1.94	2.24
February	29,700	3,710	7,768	2.53	2.63
March	29,850	3,915	9,579	3.11	3.58
April	13,960	4,320	7,038	2.29	2.55
May	4,500	2,590	3,370	1.10	1.27
June	9,200	2,430	4,147	1.35	1.51
July	4,950	1,500	2,445	.79	.91
August	9,680	1,310	2,712	.88	1.01
September	13,400	1,570	3,272	1.06	1.18
October	4,410	1,500	2,191	.71	.82
November	2,510	1,500	1,841	.60	.67
December	2,430	1,570	1,940	.63	.73
The year	29,850	1,310	4,356	1.42	19.10

ROANOKE RIVER AT ROANOKE, VA.

This station was established July 10, 1896, by D. C. Humphreys. The original gage, of the old wire type, was replaced November 28, 1903, by a standard chain gage installed by W. C. Sawyer. The datum is the same as that of the gage which it replaced. The length of the chain from the end of the weight to the marker is 27.50 feet. Discharge measurements were made from the Walnut Street Bridge, at which the gage is located, up to July 21, 1903. Since that time they have been made from the Jefferson Street Bridge, at which the section is more suitable. The initial point for soundings is the left end of the downstream handrail. The channel is nearly straight and has a width of 160 feet between abutments, broken by one pier. The current is rapid. The bed of the stream is composed of coarse gravel and small bowlders. The right bank is above high water, but the left is liable to overflow at extreme flood stages. Bench mark No. 1 is the downstream upper edge of the second floor beam from the left abutment. Its elevation is 21.98 feet above gage datum. Bench mark No. 2 is a standard copper bolt set in the face of the lower wing wall of the left abutment about 4 feet above the ground. Its elevation is 19.71 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Roanoke River at Roanoke, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 23	E. C. Murphy	6.92	6,846
May 1	do	2.01	701
May 13	E. W. Myers	1.40	349
Do	do	1.40	350
July 21	B. S. Drane	1.03	146
September 22	Paul and Sawyer	1.35	316
November 26	W. C. Sawyer	.90	120

Mean daily gage height, in feet, of Roanoke River at Roanoke, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.20	(a)	3.10	3.20	2.10	1.50	1.60	1.60	2.05	1.00	1.00	0.65
2	1.25	(a)	2.60	2.90	1.93	1.30	1.45	1.40	1.20	1.00	1.00	.90
3	4.10	1.60	2.30	2.60	1.85	1.25	1.40	1.20	1.08	.98	1.00	.90
4	2.70	2.10	2.10	2.90	1.90	1.10	1.30	2.60	1.00	1.00	1.00	.80
5	2.50	2.10	2.00	2.60	1.80	1.20	1.28	1.80	.95	.98	1.15	.95
6	2.20	2.25	1.95	2.40	1.70	1.25	1.35	1.35	.90	1.00	1.25	.85
7	1.95	2.00	2.00	2.35	1.65	2.10	1.45	1.20	.90	1.00	1.20	.90
8	1.85	1.90	2.00	2.40	1.63	1.65	1.35	1.10	.90	2.10	1.10	.80
9	1.40	1.75	2.90	2.45	1.55	1.45	1.20	1.08	2.10	1.50	1.10	.80
10	1.50	1.70	2.70	2.65	1.53	2.10	1.18	1.00	1.80	1.25	1.05	.80
11	1.50	1.80	2.40	2.40	1.50	1.90	1.50	1.05	1.10	1.15	1.00	.70
12	1.60	2.75	2.85	2.30	1.50	1.45	1.85	1.05	1.05	1.10	1.00	.75
13	1.35	2.40	2.85	2.20	1.48	1.50	2.35	1.00	1.00	1.05	1.00	.95
14	1.50	2.20	2.60	3.55	1.45	1.40	2.00	1.00	.95	1.05	1.00	.90
15	1.45	2.00	2.40	3.00	1.42	1.30	1.60	1.30	.95	1.03	1.00	.85
16	1.40	2.10	2.10	2.70	1.38	1.25	1.30	1.15	.90	1.00	1.00	.65
17	1.40	8.50	2.10	2.50	1.38	1.20	1.30	1.15	6.75	1.15	1.00	.65
18	1.35	3.50	2.00	2.30	1.38	1.20	1.25	1.18	2.60	1.45	1.10	.95
19	1.25	2.60	1.90	2.15	1.35	1.20	1.20	1.15	2.40	1.20	1.10	.55
20	1.25	2.35	1.80	2.05	1.30	1.10	1.10	1.20	1.60	1.15	1.00	.95
21	1.30	2.25	2.05	2.10	1.30	1.15	1.10	1.10	1.45	1.10	1.00	1.20
22	1.95	2.10	2.15	1.95	1.25	1.10	1.10	.95	1.35	1.05	1.00	1.05
23	1.70	2.00	6.70	1.90	1.25	1.80	1.10	.95	1.30	1.05	.98	1.00
24	1.60	1.95	4.85	1.80	1.23	1.30	1.05	.95	1.25	1.05	1.00	.95
25	1.50	1.85	3.80	1.80	1.25	1.20	1.00	.90	1.20	1.05	1.00	1.00
26	1.50	1.75	2.80	2.45	1.33	1.20	1.05	.85	1.15	1.05	1.05	1.20
27	1.45	1.70	2.55	4.05	1.30	2.10	1.00	.88	1.15	1.00	1.00	1.00
28	2.35	2.40	2.30	2.90	1.20	1.80	.95	.90	1.13	1.00	.80	1.10
29	2.40	.....	2.20	2.50	1.20	2.90	1.00	.90	1.13	1.00	.85	1.10
30	(a)	.....	4.80	2.30	1.30	2.00	.98	.90	1.08	1.00	.90	.85
31	(a)	.....	4.75	.....	1.25	.....	1.00	1.50	.....	1.00	.....	.65

a Gage broken.

Rating table for Roanoke River at Roanoke, Va., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	76	1.6	463	2.6	1,230	3.6	2,390
.7	85	1.7	521	2.7	1,330	3.7	2,515
.8	99	1.8	580	2.8	1,435	3.8	2,645
.9	121	1.9	641	2.9	1,545	3.9	2,775
1.0	151	2.0	707	3.0	1,660	4.0	2,905
1.1	189	2.1	785	3.1	1,780	4.1	3,040
1.2	237	2.2	865	3.2	1,900	4.2	3,175
1.3	290	2.3	955	3.3	2,020	4.3	3,310
1.4	347	2.4	1,045	3.4	2,140	4.4	3,445
1.5	405	2.5	1,135	3.5	2,265	4.5	3,580

Table tangent above 4 feet gage height. Differences above this point 135 per tenth. Table well determined to 2.20 feet gage height. Above 2.2 feet table is determined by two flood measurements.

Estimated monthly discharge of Roanoke River at Roanoke, Va., for 1903.

[Drainage area, 388 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 1-29 [a]	3,040	237	606	1.56	1.68
February 3-28 [a]	8,980	463	1,154	2.97	2.87
March	6,550	580	1,528	3.94	4.54
April	2,972	580	1,190	3.07	3.43
May	785	237	391	1.01	1.16
June	1,545	189	422	1.09	1.22
July	1,000	135	306	.79	.91
August	1,230	109	247	.64	.74
September	6,617	121	531	1.37	1.53
October	785	145	206	.53	.61
November	263	99	162	.42	.47
December	237	73	127	.33	.38

[a] Gage broken on days not included.

CAPE FEAR RIVER DRAINAGE BASIN.

Cape Fear River is formed by the junction, near Moncure, Chatham County, N. C., of Haw and Deep rivers. It is usual to consider the Haw, the Deep, and the Cape Fear as separate streams, and to a certain extent in a consideration of the physical features of the entire

drainage basin this method of treatment is desirable. All of these streams, however, form a single river system, and it is more convenient to treat of the basin as a whole in parts of what follows.

Viewed from this standpoint, Cape Fear River rises among the red clay hills of Guilford and Rockingham counties, N. C., the sources of Haw and Deep rivers being but a short distance apart. Haw River is the more northerly of the two branches, and flows at first northeast, but turning soon to the southeast drains the southern portion of Rockingham County and the greater part of Guilford, and passes thence through Alamance, a corner of Orange, and Chatham County to its junction with Deep River in the lower part of Chatham. Deep River at first flows south, but soon turns to the southeast and flows practically parallel with Haw River for many miles through Guilford and Randolph counties, and into Moore County, where it turns abruptly toward the east, flowing in this direction through Moore and Chatham counties to the junction with the Haw.

The area drained by the entire river system above the town of Fayetteville, N. C., the head of navigation on the river, is 4,493 square miles, of which Haw River drains 1,800, Deep River 1,400, and Cape Fear River below the junction 1,293 square miles.

The elevations of the divides between the drainage basin of the Cape Fear system and those of the adjacent streams are not very great, and the minor tributaries can not, therefore, furnish much power except in places where considerable storage may be obtained by the construction of suitable dams.

From January 1 to May 31, 1903, stations were maintained by the Geological Survey on the Cape Fear River at Fayetteville, N. C., and on Rockfish Creek, near Brunt, N. C.

CAPE FEAR RIVER NEAR FAYETTEVILLE, N. C.

This gaging station is at the bridge of the Atlantic Coast Line, about a mile east of Fayetteville, N. C. The Weather Bureau has a gage fastened on the lower side of the east abutment of the covered highway bridge, this being about 400 feet above the railroad bridge, from which discharge measurements are made. The lower 29 feet of this gage consists of a rod divided into feet and tenths and firmly fastened to the abutment. Above the 29-foot mark the scale is painted on the rock. The observer is Frank Glover, who has charge of the steamboat landing just below the railroad bridge. For his convenience he has placed a subsidiary gage at the steamboat landing reading about the same as the official gage, and from this observations are taken. The channel is straight and the current moderately swift and not influenced by dams or other obstructions. The banks are high and the total flow of the river is in one channel, even during the highest floods. The bed is fairly constant. There is a difference in elevation of 50 feet between high and low water at this point. The station was abandoned May 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Mean daily gage height, in feet, of Cape Fear River near Fayetteville, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	5.80	7.60	26.20	38.80	14.70	17	6.50	18.00	10.00	21.90	4.70
2	5.60	7.00	29.30	33.20	10.80	18	6.40	33.50	9.40	17.80	4.50
3	8.50	6.80	26.20	25.20	9.20	19	6.10	33.00	8.70	13.20	4.20
4	24.00	6.60	19.40	18.00	8.00	20	5.70	26.80	7.80	10.80	4.00
5	24.60	13.00	14.40	18.00	7.50	21	7.80	21.70	7.20	9.30	4.00
6	20.00	23.40	12.00	17.60	7.00	22	10.00	14.00	9.80	14.30	4.00
7	14.80	18.80	10.20	14.00	6.80	23	14.00	12.00	35.00	14.00	3.90
8	11.20	21.00	9.40	11.80	6.20	24	12.00	9.60	49.80	18.20	3.70
9	8.50	31.90	8.60	17.60	6.00	25	9.50	9.00	50.50	16.00	4.00
10	7.80	31.00	12.80	22.40	5.80	26	8.00	8.60	45.00	14.40	4.80
11	7.80	26.40	12.90	19.20	5.80	27	7.50	8.00	35.00	24.30	4.30
12	7.90	28.90	11.40	14.00	5.70	28	7.00	10.00	24.20	28.60	4.00
13	12.00	32.40	20.00	11.80	5.50	29	7.00	.....	18.60	24.00	4.00
14	12.30	28.40	22.40	12.00	5.40	30	8.50	.....	17.00	19.40	3.90
15	9.80	21.00	15.60	25.60	5.20	31	8.50	.....	37.70	.....	.....
16	7.00	17.80	12.70	28.20	5.00						

Rating table for Cape Fear River near Fayetteville, N. C., from January 1 to May 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.5	1,400	6.0	2,400	13.0	5,800	26.0	14,250
3.6	1,440	6.2	2,480	13.5	6,075	27.0	15,150
3.7	1,480	6.4	2,560	14.0	6,350	28.0	16,300
3.8	1,520	6.6	2,640	14.5	6,625	29.0	17,450
3.9	1,560	6.8	2,720	15.0	6,900	30.0	18,600
4.0	1,600	7.0	2,800	15.5	7,175	31.0	20,050
4.1	1,640	7.2	2,880	16.0	7,450	32.0	21,500
4.2	1,680	7.4	2,960	16.5	7,725	33.0	22,950
4.3	1,720	7.6	3,050	17.0	8,000	34.0	24,650
4.4	1,760	7.8	3,150	17.5	8,275	35.0	26,350
4.5	1,800	8.0	3,250	18.0	8,550	36.0	28,050
4.6	1,840	8.5	3,500	18.5	8,875	37.0	29,800
4.7	1,880	9.0	3,750	19.0	9,200	38.0	31,550
4.8	1,920	9.5	4,000	19.5	9,525	39.0	33,300
4.9	1,960	10.0	4,250	20.0	9,850	40.0	35,050
5.0	2,000	10.5	4,500	21.0	10,500	41.0	36,800
5.2	2,080	11.0	4,750	22.0	11,150	42.0	38,550
5.4	2,160	11.5	5,000	23.0	11,800		
5.6	2,240	12.0	5,250	24.0	12,450		
5.8	2,320	12.5	5,525	25.0	13,350		

Rating table for 1903 same as those for 1901 and 1902.

Estimated monthly discharge of Cape Fear River near Fayetteville, N. C., for 1903.

[Drainage area, 4,493 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	12,990	2,240	4,430	0.99	1.14
February	23,800	2,640	10,409	2.32	2.42
March	54,525	2,880	13,453	2.99	3.45
April	32,950	3,900	10,137	2.26	2.52
May 1–30	6,735	1,480	2,348	.52	.58

ROCKFISH CREEK NEAR BRUNT, N. C.

This station was established on October 29, 1902, by B. S. Drane. The gage rod is of pine, 12 feet long, well painted, and graduated to tenths and half-tenths of a foot. It is firmly nailed on the outside of the downstream hand rail, between the two large posts, approximately over the center of the bridge. The distance from the zero of the gage to the outer rim of the pulley is 1 foot. The length of the wire from the end of the weight to the pointer is 51.80 feet. The gage reads zero when the weight touches the bottom. The observer was C. L. Nunalee, a farmer and storekeeper; his post-office address is Brunt, N. C. The course of the creek is straight here for about 500 yards, Lower Rockfish Bridge crossing the creek near the middle of this straight stretch. The left side of the stream is shallow, most of the current flowing along the right bank. The banks of the creek, of sand, rise steeply on either side to a height of about 50 feet.

The station is reached by driving from Fayetteville, N. C., a distance of 7 miles. It was discontinued May 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer. The following discharge measurement was made by E. W. Myers in 1903:

May 27: Gage height, 4.15 feet; discharge, 563 second-feet.

Mean daily gage height, in feet, of Rockfish Creek near Brunt, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.83	4.07	19.17	31.28	8.90	4.20	17	4.22	12.70	5.00	16.50	4.17	.....
2	4.05	4.02	22.17	28.97	5.80	4.40	18	4.15	24.75	4.40	11.25	3.95	.....
3	5.87	4.25	17.42	18.87	4.55	4.00	19	3.57	26.10	4.40	8.30	4.25	.....
4	18.70	4.35	12.55	13.15	4.30	3.85	20	4.17	20.25	4.40	5.20	4.17	.....
5	18.32	8.35	8.57	11.25	4.45	4.20	21	4.97	16.95	4.65	5.55	3.90	.....
6	17.05	16.60	5.98	10.75	4.45	4.50	22	5.40	10.00	8.10	6.85	4.65	.....
7	12.70	12.20	5.40	8.10	4.40	.....	23	7.72	6.05	25.85	7.95	4.02	.....
8	8.47	13.30	4.50	6.55	4.25	.....	24	6.30	5.45	41.50	10.80	3.95	.....
9	5.27	26.35	4.50	5.00	4.25	.....	25	4.60	4.62	42.45	9.70	4.25	.....
10	4.27	26.72	6.55	15.00	4.45	.....	26	3.82	4.60	37.65	8.60	4.45	.....
11	4.10	17.22	6.75	12.40	4.25	.....	27	4.26	4.62	27.80	17.55	4.15	.....
12	4.50	19.20	5.95	8.65	4.35	.....	28	4.22	6.30	18.45	21.55	4.55	.....
13	6.00	25.55	12.75	6.00	4.40	.....	29	4.17	.....	11.92	18.05	4.10	.....
14	5.82	21.42	12.90	8.75	4.40	.....	30	4.40	.....	14.60	13.25	4.30	.....
15	4.72	16.80	9.50	20.00	4.35	.....	31	4.40	.....	30.02	.....	4.75	.....
16	3.95	11.45	6.65	16.80	4.35	.....							

MISCELLANEOUS MEASUREMENTS MADE IN CAPE FEAR RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in 1903:

Miscellaneous measurements in Cape Fear drainage basin.

Date.	Streams.	Locality.	Discharge.
			Second-feet.
May 27	Little Rockfish Creek	McNeils, N. C	143
May 27	Big Rockfish Creek	do	361
May 27	do	do	346
May 27	do	do	345

PEDEE, OR YADKIN, RIVER DRAINAGE BASIN.

The Yadkin River, or, as it is called below the junction of the Uharie, the Pedee, rises on the eastern slope of the Blue Ridge, in Caldwell and Watauga counties, N. C., and flows at first southeast, then turns abruptly northeast and flows in this direction for about 60 miles, then bends again abruptly and flows south and southeast across North Carolina and South Carolina, emptying into Winyah Bay at Georgetown, S. C. The total length of the stream, from source to mouth, following its general direction, is from 275 to 300 miles, while it is probably 400 miles or more if all the windings be followed.

The Pedee drains a total area of about 17,000 square miles, of which about 9,700 square miles are in North Carolina and 7,300 in South Carolina. The stream crosses the fall line near Cheraw, S. C.,

in a series of rapids extending over a number of miles, with no very great fall at any one place or in any short distance.

Small amounts of power may be developed on some of the tributaries of this stream in South Carolina, but the power possibilities of the basin in this State are unimportant. In North Carolina the stream can be made to furnish power in large quantities at a number of places, and large amounts may be secured on many of the tributaries. This stream and its tributaries are among the most important power streams in the southern States.

Below the great bend, where the river turns to the south, the valley of the stream averages about 50 miles in width. At many points the river is bordered by wide expanses of bottom lands, which are at times subject to overflow, and which are fertile and very productive. At other places the river is confined between bold and abrupt banks, and in one case it flows for several miles in a very narrow channel, only 60 feet wide in places, in a deep ravine between the flanking hills, forming the noted "Narrows." Above the great bend the valley is only from 15 to 20 miles wide, and the elevations of the divides which separate the basin of the Yadkin from those adjacent are much higher, so that the tributary streams have a large fall.

The upper part of the drainage basin is rough and mountainous and largely forest covered, and throughout this part of its course the flow of the stream is more constant than would be expected.

The average rainfall over the part of the basin in North Carolina is probably between 48 and 51 inches, approximating the lower figure over the lower portions, and possibly exceeding 51 inches over the higher and more mountainous portions, the precipitation increasing as the stream is ascended. This total amount is rather evenly distributed among the seasons.

The highest flood ever known at Wilkesboro, it is stated, occurred in March, 1899, the stream at this place rising 28 feet above low water. The greatest flood recorded at the gaging station at Salisbury, N. C., occurred in December, 1901, the stream reaching an extreme height on the gage of 19.7 feet and having a probable discharge of about 130,000 second-feet, or about 38 second-feet per square mile. The flood of March, 1899, produced a rise of about 1 foot less than this flood of December. The most destructive flood ever experienced on the stream occurred in May, 1901, but the recorded gage height at the Salisbury station was less for this flood than for either of the others mentioned, and the general testimony of those living along the banks is to the same effect.

The minimum recorded flow at the Salisbury station occurred in September, October, and November, 1897, when the basin of the stream experienced the most severe drought in its history. The flow fell to 900 second-feet several times during this period, or the basin above the station was discharging at an average rate of 0.26 second-

foot per square mile. The maximum flow is thus about 144 times the minimum.

As stated, there are a number of localities where power may be developed.

During 1903 the United States Geological Survey received data from M. R. Hall, district hydrographer, for stations on Yadkin River near Salisbury, N. C., and at North Wilkesboro, N. C.

YADKIN RIVER NEAR SALISBURY, N. C.

This station was established by C. C. Babb, September 24, 1895, at the Southern Railway bridge about 6 miles east of Salisbury, N. C. Measurements were made from the decked railroad bridge, from which the original wire gage was also suspended. During the year 1899 the location of the measuring station and wire gage was changed to a new iron highway bridge about 300 yards above, the gage being set to read the same as the original one. Early in 1903 it was decided that the original location at the railroad bridge was better, so the station was again changed to it. This time, however, the gage was located on a plank walk way supported by the lower members of the bridge, and from this walk way the discharge measurements are also made. The bridge is a four-span iron bridge of the decked type, having a total length of about 650 feet between stone abutments, the left bank abutment being at the edge of the high rocky bluff, while that at right bank is connected with the hill by a short earth embankment. The river is confined by the abutments at all stages, and occupies practically the whole width at low water.

The channel is straight for long distance below, but curves considerably above. The bed of the river is rocky, and the depth of water is fairly uniform. Current is good, even at lowest stages. The initial point for soundings is the end of the bridge at right bank. The new gage is a standard, inclosed-scale, boxed-chain gage, and is fastened to lower member of the bridge along the plank walk way, near the middle of the first span from right bank. The length of the gage chain from the end of the weight to the marker is 28.66 feet. The observer is J. T. Yarbrough, the bridge keeper.

Bench mark No. 1 is the top of the inside eye bar of the lower chord on the downstream side, in the fourth panel from the right end of the bridge opposite a point 80 feet from the initial point for soundings. It is marked with white paint and has an elevation of 27.28 feet above gage datum. Bench mark No. 2 is the top of the anchor-bolt head at the right downstream corner of the foot plate on the right abutment downstream side. Its elevation is 26.82 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Yadkin River near Salisbury, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 14	E. W. Myers	4.20	9,992
February 17	do	10.52	47,960
March 24	E. C. Murphy	15.60	70,362
March 26	B. S. Drane	5.56	15,094
April 15	E. C. Murphy	7.35	24,419
April 16	E. W. Myers	5.20	15,151
Do	E. C. Murphy	5.22	12,287
Do	do	4.95	11,787
June 20	E. W. Myers	2.60	4,286
August 22	B. S. Drane	2.35	4,490
Do	do	2.35	3,453
October 27	do	1.95	2,197
November 14	do	1.89	2,416
December 17	do	1.75	2,053

Mean daily gage height, in feet, of Yadkin River near Salisbury, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.55	3.00	7.55	6.35	3.20	3.30	2.70	2.55	2.75	1.80	1.82	1.80
2	2.40	2.85	5.90	4.70	3.15	2.88	2.40	5.00	1.85	1.80	1.90	1.75
3	10.40	2.80	4.30	4.25	3.05	2.80	2.40	3.10	2.19	1.90	1.75	1.80
4	10.05	4.40	3.70	4.10	3.15	2.80	2.45	2.40	2.08	1.85	1.76	1.74
5	6.07	8.67	3.50	4.95	3.15	2.84	2.50	3.40	1.94	1.95	2.38	1.75
6	4.47	6.60	3.38	4.10	3.10	3.80	2.60	3.00	1.88	1.79	2.85	1.88
7	3.79	4.05	3.45	3.80	3.05	8.30	3.60	2.90	2.20	1.88	2.30	1.90
8	3.45	5.50	3.50	7.25	3.00	9.40	2.90	2.30	2.10	1.83	1.96	1.75
9	3.15	6.50	5.66	10.65	2.95	4.60	2.50	2.10	3.80	3.81	2.00	1.65
10	2.90	5.00	4.72	7.50	2.70	3.50	2.50	2.05	3.85	2.96	1.80	1.68
11	2.80	4.45	5.20	5.10	2.95	3.85	2.20	1.85	2.19	2.22	1.80	1.80
12	3.35	6.45	5.59	4.35	2.85	3.75	2.35	2.40	1.95	2.09	1.75	1.62
13	3.40	5.65	5.15	4.55	2.80	3.25	2.55	3.15	1.90	1.86	1.72	1.88
14	2.90	4.25	4.45	6.95	2.90	2.88	3.70	2.75	1.92	1.65	1.75	2.02
15	2.80	3.70	4.00	7.15	2.90	2.80	2.80	2.80	1.80	1.84	1.85	1.90
16	2.80	3.50	3.70	5.50	2.90	2.65	2.50	4.20	1.80	1.81	1.90	1.80
17	2.75	9.95	3.50	4.35	2.80	2.55	2.20	3.15	6.25	1.89	1.78	1.70
18	2.78	10.50	3.40	3.95	2.70	2.85	2.15	3.70	7.00	2.06	2.78	1.70
19	2.60	5.65	3.55	3.70	2.70	2.85	2.10	4.05	4.02	2.53	2.90	1.70
20	2.55	4.12	3.25	3.65	2.65	2.55	3.30	3.05	2.80	2.02	2.30	1.75
21	2.60	3.75	4.05	3.80	2.65	2.60	2.25	2.85	2.25	1.91	1.90	2.35
22	3.70	3.55	8.30	3.88	2.65	2.60	2.05	2.40	2.02	1.96	2.00	2.60
23	3.50	3.45	10.30	3.60	2.60	2.80	1.95	2.20	1.82	1.86	2.04	2.20
24	3.10	3.25	15.40	3.55	2.55	2.45	2.20	2.12	1.85	1.85	1.70	2.05
25	3.00	3.20	10.60	3.44	2.55	2.80	1.85	1.90	1.87	1.85	1.80	2.05
26	2.90	3.15	6.00	3.50	2.55	2.80	1.90	2.00	1.87	1.94	1.80	2.15
27	2.75	3.05	4.50	3.65	2.68	3.65	1.95	1.75	1.96	1.74	1.80	2.15
28	3.65	4.15	4.15	3.58	2.65	3.70	1.75	1.79	1.95	1.75	1.75	1.98
29	4.10	.....	3.95	3.32	4.40	3.30	1.85	1.80	1.75	1.64	1.82	1.75
30	3.45	.....	5.50	3.25	3.10	3.15	2.55	1.85	1.85	1.70	1.90	1.88
31	3.10	.....	8.80	.....	3.18	.....	2.55	2.84	.....	1.72	.....	1.80

Rating table for Yadkin River near Salisbury, N. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.6	1,500	2.9	5,350	4.2	9,670	6.0	16,750
1.7	1,740	3.0	5,670	4.3	10,020	6.2	17,610
1.8	1,990	3.1	5,990	4.4	10,370	6.4	18,470
1.9	2,260	3.2	6,310	4.5	10,720	6.6	19,340
2.0	2,540	3.3	6,640	4.6	11,080	6.8	20,220
2.1	2,830	3.4	6,970	4.7	11,450	7.0	21,100
2.2	3,130	3.5	7,300	4.8	11,830	7.5	23,350
2.3	3,440	3.6	7,630	4.9	12,210	8.0	25,650
2.4	3,750	3.7	7,960	5.0	12,600	9.0	30,400
2.5	4,070	3.8	8,300	5.2	13,410	10.0	35,750
2.6	4,390	3.9	8,640	5.4	14,230	11.0	41,700
2.7	4,710	4.0	8,980	5.6	15,070		
2.8	5,030	4.1	9,320	5.8	15,910		

Table well determined to 6 feet gage height. Above 5.6 feet table same as 1901 and 1902.

Estimated monthly discharge of Yadkin River near Salisbury, N. C., for 1903.

[Drainage area, 3,399 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	38,070	3,750	8,421	2.48	2.86
February	38,650	5,030	12,677	3.73	3.88
March	76,200	6,475	15,798	4.65	5.36
April	39,565	6,475	12,174	3.58	3.99
May	10,370	4,230	5,393	1.59	1.83
June	32,480	3,910	7,446	2.19	2.44
July	7,960	1,865	3,872	1.14	1.31
August	12,600	1,865	4,744	1.40	1.61
September	21,100	1,865	4,343	1.28	1.43
October	8,300	1,620	2,536	.75	.86
November	5,350	1,740	2,542	.75	.84
December	4,390	1,500	2,260	.66	.76
The year	76,200	1,500	6,850	2.02	27.17

YADKIN RIVER AT NORTH WILKESBORO, N. C.

This station was established April 10, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at the lower highway bridge between Wilkesboro and North Wilkesboro, about one-half mile below North Wilkesboro railroad station and about three-fourths of a mile below the mouth of Reddies River. The scale of the standard chain gage is fastened to the downstream guard rail with its zero 7.63 feet east of the center of the second strut from the west end of the span. The distance from the end of the weight to the marker is 33.38 feet. The gage was read once each day during 1903 by J. V. Wallace. He was succeeded December 20, 1903, by U. H. Wyatt. Discharge measurements are made from the downstream side of the steel highway bridge to which the gage is attached. The bridge consists of a single steel span about 125 feet long, under which the river flows at ordinary stages, and three wooden spans about 50 feet each on the right bank. There are also wooden trestle approaches about 170 feet long on the right bank and about 40 feet on the left bank. The initial point for soundings is the end of the downstream guard rail at the left end of the bridge. Distances are measured along this guard rail and are marked in white paint. The channel is straight above the station, but makes a very slight curve beneath the bridge. Below the station the channel is straight for about 600 feet. The water is swift both above and below. The right bank is low and is subject to overflow, but all water must pass beneath the bridge and its approaches. The left bank is high and rocky and does not overflow at the bridge. Above the bridge the river is subject to overflow. The bed of the stream is rocky, with sand in places. There is a single channel at all stages.

Bench mark No. 1 is the top surface of the outer eyebar of the lower chord opposite a point 100 feet from the initial point for soundings. When the gage reads zero the water surface is 30.75 feet below this bench mark. Bench mark No. 2 is the top corner of the pulley frame above the hole in the box which incloses the chain. When the gage reads zero the water surface is 31.88 feet below this bench mark.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Yadkin River at North Wilkesboro, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 10	E. W. Myers	4.00	2,969
April 11	do	3.67	2,797
June 16	do	1.56	977
Do	do	1.56	1,005
June 17	do	1.46	965
July 16	B. S. Drane	1.15	865
Do	do	1.17	830
August 24	do	.76	675
Do	do	.73	659
August 25	do	.71	630
October 2	do	.41	509
Do	do	.40	479
October 3	do	.37	491
November 6	do	.71	691
Do	do	.71	693

Mean daily gage height, in feet, of Yadkin River at North Wilkesboro, N. C., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.25	1.75	1.35	2.25	1.85	0.40	0.40	0.30
2		2.20	1.85	1.25	1.50	.85	.40	.40	.40
3		2.20	2.15	1.40	1.40	.80	.40	.40	.40
4		2.30	1.70	1.25	1.90	.70	.35	.50	.40
5		2.20	2.45	3.15	1.50	.70	.35	1.80	.40
6		2.10	6.75	2.25	1.20	.60	.35	.75	.30
7		2.10	4.45	2.15	1.00	.60	.70	.55	.35
8		2.05	3.05	1.55	.85	.60	7.20	.50	.35
9		2.00	2.45	1.40	.85	.55	1.35	.50	.30
10	3.95	1.95	3.20	1.30	.80	.90	.80	.50	.35
11	3.65	1.95	2.35	1.20	1.35	.65	.60	.45	.30
12	3.35	1.90	2.25	1.50	.90	.55	.55	.45	.30
13	4.25	1.90	1.95	2.05	.80	.50	.50	.45	.45
14	3.85	2.15	1.85	1.60	.95	.50	.50	.40	.35
15	3.80	1.90	1.80	1.30	1.80	.45	.45	.35	.30
16	3.40	1.85	1.65	1.20	1.25	.60	.60	.40	.15
17	3.15	1.75	1.45	1.35	1.75	2.45	1.55	.90	.25
18	3.00	1.75	1.45	1.20	1.65	.95	1.20	1.15	.15
19	2.95	1.65	1.40	1.05	1.25	.75	.80	.60	.05
20	2.85	1.65	1.40	1.05	1.15	.65	.65	.50	.90
21	2.80	1.65	1.35	.95	1.00	.60	.55	.50	.95
22	2.70	1.60	1.30	.95	.90	.55	.50	.45	.55
23	2.65	1.55	1.30	.90	.80	.55	.55	.45	.40
24	2.50	1.50	1.45	.85	.80	.55	.50	.45	.40
25	2.60	2.00	1.75	.85	.75	.50	.45	.40	.45

Mean daily gage height, in feet, of Yadkin River, etc.—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	2.60	1.60	1.65	0.80	0.70	0.50	0.45	0.40	0.55
27	2.45	1.65	1.80	.75	.60	.50	.40	.30	.10
28	2.35	1.70	1.95	.75	.60	.50	.35	.25	.55
29	2.30	1.70	1.95	1.10	.55	.40	.40	.40	.35
30	2.30	2.00	1.45	.90	1.10	.40	.40	.40	.30
31	.....	1.85	.....	1.20	.80	.....	.40	.....	.30

Rating table for Yadkin River at North Wilkesboro, N. C., from April 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.05	365	0.8	680	1.6	1,018	2.4	1,490
.1	386	.9	722	1.7	1,065	2.5	1,570
.2	428	1.0	764	1.8	1,115	2.6	1,650
.3	470	1.1	806	1.9	1,165	2.7	1,730
.4	512	1.2	848	2.0	1,220	2.8	1,820
.5	554	1.3	890	2.1	1,280	2.9	1,920
.6	596	1.4	932	2.2	1,345		
.7	638	1.5	974	2.3	1,415		

Table uncertain above 1.6 feet gage height; the curve is a tangent above gage height 2.8 feet; differences 100 per tenth.

Estimated monthly discharge of Yadkin River at North Wilkesboro, N. C., for 1903.

[Drainage area, 498 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April 10–30	3,270	1,415	2,064	4.15	3.24
May	1,415	974	1,169	2.35	2.71
June	5,770	890	1,417	2.85	3.18
July	2,170	659	916	1.84	2.12
August	1,380	575	815	1.64	1.89
September	1,530	512	647	1.30	1.45
October	6,220	491	770	1.55	1.79
November	1,115	449	568	1.14	1.27
December	743	365	502	1.01	1.16

MISCELLANEOUS MEASUREMENTS IN PEDEE RIVER DRAINAGE BASIN.

The following discharge measurements were made in Pedee River drainage basin in 1903:

Miscellaneous measurements in Pedee River drainage basin in 1903.

Date.	Stream.	Locality.	Discharge.
			Second-feet.
Nov. 7	Mulberry Creek	Near North Wilkesboro, N. C.	47
Nov. 10	Stewarts Creek	Mount Airy, N. C	87
Nov. 10	Lovells Creek	do	44
Nov. 10	Ararat River [a]	do	200
Nov. 11	do. [b]	do	71

[a] Below Lovells and Stewarts creeks. [b] Above Lovells and Stewarts creeks.

SANTEE RIVER DRAINAGE BASIN.

Santee River is formed by the junction of Congaree and Wateree rivers in the central part of South Carolina. It flows southeast and enters the Atlantic Ocean about 10 miles north of Cape Romain. It has a total length of about 180 miles (following the course of the river) and drains an area of about 15,000 square miles. It is a navigable stream for its entire length, and of course offers no opportunities for the development of power.

Wateree River, the more northerly of the two parent streams, rises on the eastern slope of the Blue Ridge, in McDowell County, N. C., and flows first northeast and then east, then bends abruptly southeast and flows in this general direction across the south-central portion of North Carolina and across the north-central part of South Carolina to its junction with the Congaree, practically paralleling the course of Yadkin and Pedee rivers. This stream, throughout its course in North Carolina, and also through that part of its course in South Carolina above the mouth of Wateree Creek, is known as Catawba River. The total length of the stream is about 270 miles in a straight line, and about 450 miles when all the windings are followed.

The Wateree is navigable as far as Camden, but above this point the fall becomes too great and navigation is impracticable. In 1826 and following years the State of South Carolina spent large sums in the attempt to render the river navigable by means of locks and dams. Some large and important works were constructed at great expense, but the undertaking was abandoned before their completion.

The drainage basin resembles that of the Yadkin in many respects, the upper portion of the stream flowing between parallel ranges of mountains from which it receives many tributaries affording much power. The average width of the valley of the main stream in North

Carolina is only from 15 to 20 miles, and the fall in the main stream in considerable. The greater part of the drainage basin is hilly, and the upper portions are mountainous. A number of the tributary streams rise and flow for almost their entire length in high mountains. About 65 per cent of the upper part of the basin is in forest. Linville River and John River, the principal tributaries in North Carolina, flow in country of this character, and their basins are almost entirely forested.

Wateree River crosses the fall line about 5 miles above Camden, S. C., in rapids about 5 miles in length, with a total fall of about 52 feet. The Great Falls of the Catawba are some distance above. This is the largest power in South Carolina, and one of the largest in the Southern States, the available fall being 173 feet.

The average rainfall on the basin is about 50 inches, the annual total increasing as the stream is ascended. The greatest flood ever experienced on the river was in May, 1901, the gage reading at the Rockhill station being 24.15 feet and the measured discharge nearly 151,000 second-feet, or nearly 50 second-feet per square mile from the drainage basin above the station. The greatest flood previously experienced on the stream was in 1865. This was only about 2 feet lower than the flood of May on the lower part of the river, but the May rise exceeded all previous records on the upper portion of the river by from 8 to 15 feet.

The minimum flow recorded for the Rockhill station is 1,300 second-feet, or about 0.43 second-foot per square mile. The maximum flow is about 116 times the minimum.

The Congaree, the second and more southerly of the two streams which by their union form the Santee, is formed by the junction of Broad and Saluda rivers between Lexington and Richland counties, S. C., whence it flows in a general southeasterly direction, but in a very tortuous channel, for about 60 miles to its junction with the Wateree. The stream is navigable to Columbia, the capital of the State. There it crosses the fall line, giving rise to a very fine water power, the only one on the stream, which is being extensively used in the manufacturing enterprises of Columbia.

Broad River rises on the eastern slope of the Blue Ridge near Hickory Nut Gap, in the southwestern part of McDowell County and the northeastern part of Henderson County, N. C., and flows in a general southeasterly direction across a portion of south-central North Carolina and north-central South Carolina to its junction with the Saluda at Columbia. The length of the river in a straight line is about 128 miles, but it is much greater if the course of the river is followed.

In general character the drainage basin closely resembles those of the Yadkin and the Catawba. It lies entirely above the fall line, is without lakes, and is well wooded, especially in the upper portion, and the soil is generally loose and porous.

The rainfall of the basin averages about 51 inches, of which about 13 inches fall in spring, the same in summer, about 10 in autumn, and about 15 in winter. It is probable that the precipitation in the region about the headwaters is much greater than these amounts indicate.

The maximum flood recorded at the Alston station on this stream, 25 miles above Columbia, occurred in May, 1901, the estimated discharge being 131,000 second-feet, equivalent to about 28 second-feet per square mile. The minimum flow recorded at the same place is 1,660 second-feet, equivalent to 0.36 second-foot per square mile. The maximum flow is therefore about 79 times the minimum.

Saluda River is formed in western South Carolina by the junction of the north, south, and middle forks, and flows southeast to its junction with Broad River, the length of the stream being about 110 miles in a straight line. The three forks are mountain streams, and the character of the drainage basin is similar to that of Broad River.

The average rainfall over the basin of the stream is 51 inches, the amount and seasonal distribution being similar to that on the Broad. The maximum flood recorded at the Waterloo station on this stream occurred in February, 1902, the rise being 23 feet above low water, and the estimated discharge being about 18,500 second-feet, equivalent to about 18 second-feet per square mile. The minimum discharge so far recorded is 290 second-feet, or about 0.28 second-foot per square mile. The maximum discharge is therefore about 64 times the minimum.

During 1903 the United States Geological Survey has maintained the following stations in this basin, under the direction of M. R. Hall: On the Wateree, near Camden, S. C.; on the Catawba, near Catawba, S. C., near Rockhill, S. C., and near Morganton, N. C.; on the Broad (of the Carolinas), near Alston, S. C.; and on the Saluda, near Waterloo, S. C.

WATEREE RIVER NEAR CAMDEN, S. C.

Camden, S. C., is on the Wateree River 45 miles above its mouth, and about 5 miles below the fall line. The drainage area above the station is 2,635 square miles.

A gaging station has been maintained here by the United States Weather Bureau since 1891. The present gage is at the toll bridge about 2 miles west of Camden. Measurements are made from this bridge which is two iron spans about 180 feet each, supported by tubular iron piers, and has short wooden approaches. The bridge keeper is also river observer. The gage is in three sections; the lower section being a timber fastened to a log near the right bank and about 15 feet above the bridge, and reading from 0 to 8 feet. The second is a timber fastened to an ash tree on right bank about 25 feet above bridge, and reading up to 15 feet. The third section, 15 to 32 feet, is painted on the upstream cylindrical pier on right bank.

There is some discrepancy between the middle section and the

other two. The readings have been adjusted with the upper section of gage on the pier. A new gage will be put in and set to read the same as the gage on the pier.

Both banks are high, but will probably overflow at high floods. The current is smooth and moderate at station and above and below it. The channel is 270 feet wide at low water, and the bed is sand and silt and is probably shifting.

Discharge measurements of Wateree River near Camden, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 26	Myers and Drane	7.35	3,929
June 23	B. S. Drane	9.75	6,222
Do	do	9.90	6,694
August 7	J. M. Giles	9.15	6,285

Mean daily gage height, in feet, of Wateree River near Camden, S. C., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.[b]	May[c]	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.00	7.60	26.20	.....	.....	8.00	8.70	7.50	7.00	5.60	6.10	6.00
2	7.00	6.80	27.00	.....	.....	9.30	8.50	9.00	10.70	5.60	6.30	6.00
3	14.00	6.70	22.00	.....	.....	13.00	7.90	8.30	8.00	5.60	6.40	6.00
4	27.00	6.60	16.70	.....	.....	13.30	7.70	7.80	7.70	5.20	6.20	6.00
5	26.00	13.60	13.00	.....	.....	14.30	7.50	8.50	7.00	5.20	6.30	6.00
6	21.00	22.20	12.50	.....	.....	17.50	7.30	8.00	7.00	5.20	12.00	6.00
7	16.80	17.70	11.00	.....	.....	27.50	9.40	9.00	6.70	5.20	10.00	6.00
8	11.70	27.50	12.00	.....	.....	28.30	10.60	10.00	6.40	5.20	8.50	6.00
9	9.00	29.40	16.00	.....	.....	23.50	8.80	9.60	6.40	5.80	8.00	6.10
10	8.00	26.60	18.60	.....	.....	22.70	8.50	8.60	10.00	5.60	7.00	6.60
11	8.00	21.00	18.50	.....	.....	17.80	8.00	8.00	9.00	8.00	6.70	6.50
12	8.30	27.70	19.70	.....	.....	23.60	7.70	7.40	8.00	7.60	6.70	6.40
13	12.50	26.90	19.40	.....	.....	18.50	7.30	7.00	7.00	7.00	6.60	6.50
14	9.50	22.50	17.20	.....	.....	13.00	11.00	9.70	7.00	7.00	6.60	6.40
15	8.50	17.40	13.40	.....	8.00	11.00	10.40	10.00	6.50	7.00	6.60	6.30
16	7.30	13.00	12.50	.....	7.70	9.60	9.00	15.00	6.00	7.10	6.60	6.30
17	7.20	21.70	11.50	.....	7.50	9.30	8.80	15.70	15.00	7.20	6.40	6.30
18	6.70	27.70	10.00	.....	7.30	9.10	8.20	15.00	20.00	12.00	6.40	6.30
19	6.50	26.00	8.70	.....	7.10	8.70	8.00	18.30	16.50	10.00	7.00	6.30
20	6.30	20.60	8.00	.....	7.00	8.60	7.70	17.50	11.00	8.00	9.00	6.30
21	6.70	14.60	7.50	.....	6.90	8.80	7.40	11.00	8.00	7.50	8.20	6.20
22	7.60	13.00	25.00	.....	6.80	9.00	7.10	9.00	7.00	7.00	7.00	6.00
23	7.30	12.00	28.20	.....	6.40	9.30	7.30	8.00	6.20	6.50	6.80	6.00
24	7.10	11.00	29.30	.....	6.30	11.70	8.00	7.90	6.00	6.40	6.40	6.00
25	7.00	10.50	30.40	.....	6.20	13.50	7.80	7.40	6.00	7.00	6.40	6.40
26	6.80	9.00	27.70	.....	6.10	11.00	7.60	7.00	6.00	6.50	6.40	6.50
27	6.60	8.50	20.70	.....	6.00	10.40	7.50	6.40	6.00	6.40	6.30	7.50
28	6.90	11.00	16.00	.....	5.90	10.20	7.30	6.00	6.00	6.20	6.00	7.00
29	9.50	.....	13.00	.....	8.30	10.50	7.00	6.00	6.00	6.20	6.00	6.50
30	9.20	.....	23.20	.....	8.60	9.50	6.90	6.00	5.80	6.20	6.00	6.60
31	7.70	.....	27.60	.....	8.70	.....	8.50	6.00	.....	6.20	.....	6.50

[a] Furnished by United States Weather Bureau. [b] No record. [c] No record for May 1 to 14.

CATAWBA RIVER NEAR CATAWBA, S. C.

This station was established in order to continue the records on Catawba River after the Rockhill station had been abandoned. No very favorable section was found; but this one was selected as the most available one, and a temporary gage was put in by J. M. Giles on September 11, 1903, in order to start the gage-height records.

The station is located at the bridge of the Southern Railway, 2 miles southeast of Catawba, S. C., and about 2 miles below the crossing of the Seaboard Air Line Railway. The deck bridge, from which measurements are made, is a three-span wooden-lattice structure about 520 feet long, with 250 feet of trestle approach on right bank and 160 feet on the left bank. At ordinary stages the river is about 490 feet wide; at high stages the banks, which are rather high, will overflow to some extent, but all water will pass under the bridge and its approaches. The bed is partly rock and will probably shift little. The channel is straight above and below the bridge. The current is sluggish at low water—rather too much so for accurate work. The bridge is not quite at right angles with the current and corrections are made to the widths in computing measurements.

The measurements are made from a plank footway on the lower members of the bridge. The initial point for soundings is the river edge of the capstone on the left bank pier. The gage is a vertical 1 by 4 inch timber, reading from zero to 10 feet, and consists of two 5-foot sections fastened to a 3 by 10 inch timber, which is driven into the bed of the river and spiked to a willow tree. It is located on the left bank of the river, about 85 feet above the bridge.

Bench mark No. 1 is the top of the joint plate on the upstream bottom chord, at a point 44 feet from the initial point. Its elevation is 31 feet above the zero of the gage. Bench mark No. 2 is a standard copper plug set in a sycamore tree 10 feet from the edge of the river and about 100 feet upstream from the bridge. Its elevation is 10.86 feet above the zero of the gage.

The observer is J. Y. Brice, who is conveniently located at the railroad pump house near by. During 1903 the gage was read once a day. During 1904 it will be read twice a day.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Catawba River near Catawba, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge
		Feet.	*Second-feet.*
September 11	J. M. Giles	3.02	3,944
October 23	do	2.30	2,253
December 11	do	2.40	2,057
August 10	do	[a] 2.52	2,506

[a] From bench mark.

Mean daily gage height, in feet, of Catawba River near Catawba, S. C., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	2.30	2.80	2.30	12	2.60	2.40	2.40	2.40	23	2.50	2.30	2.40	2.70
2	.....	2.20	2.30	2.30	13	2.50	2.40	2.40	2.30	24	2.40	2.70	2.50	2.60
3	.....	2.20	2.30	2.30	14	2.30	2.30	2.40	2.30	25	2.50	2.60	2.50	2.50
4	.....	2.20	2.30	2.30	15	2.30	2.30	2.40	2.30	26	2.30	2.30	2.40	2.90
5	.....	2.20	3.90	2.30	16	2.30	2.20	2.40	2.40	27	2.30	2.30	2.40	2.70
6	.....	2.20	3.60	2.30	17	7.20	2.30	2.40	2.30	28	2.30	2.30	2.40	2.50
7	.....	2.20	3.10	2.30	18	6.90	3.10	2.60	2.30	29	2.20	2.30	2.30	2.50
8	.....	2.30	2.70	2.30	19	4.00	2.60	3.40	2.30	30	2.30	2.30	2.30	2.40
9	.....	2.60	2.40	2.40	20	3.00	2.60	3.20	2.30	31	.....	2.30	.....	2.40
10	.....	3.40	2.40	2.40	21	2.60	2.50	2.80	2.50					
11	3.00	2.80	2.40	2.40	22	2.50	2.30	2.60	2.60					

CATAWBA RIVER NEAR ROCKHILL, S. C.

This station was established by C. C. Babb on September 3, 1895, and was discontinued May 31, 1903. It was located at the bridge of the Southern Railway, 3 miles south of Fort Mill, S. C., and about 60 miles below the Catawba station, now abandoned. A wire gage of the ordinary type is fastened to the upstream guard rail on the upper side, the 2-foot mark on the rod being over the center of the second vertical compression member of the second truss from the south end of the bridge. The distance from the zero of the rod to the outside edge of the pulley wheel is 1.3 feet, and from the end of the weight to the pointer on the wire is 52.96 feet.

The channel of the stream is curved above and below the bridge, which crosses at the head of a bend. The current flows at an angle with the bridge and is swift; the water is shallow at ordinary stages of the stream, and the bottom rough. Altogether, the station was a poor one. The observer was D. A. Morris, a farmer living near the bridge.

The station is reached from Rockhill by private conveyance.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer. The following discharge measurement was made by E. W. Myers in 1903:

March 24: Gage height, 17.75 feet; discharge, 96,981 second-feet.

Mean daily gage height, in feet, of Catawba River near Rockhill, S. C., for 1903.

Day.	Jan.	Feb	Mar.	Apr.	May.	June.	July.
1	2.20	2.40	8.87	8.00	2.80	2.80	2.40
2	2.10	2.30	6.50	5.35	2.75	2.80	2.20
3	10.00	2.20	4.20	4.40	2.70	3.20	2.20
4	8.50	2.40	3.50	4.10	2.70	3.20	2.15
5	5.70	6.15	3.20	4.20	2.70	3.00	2.15
6	3.90	5.20	3.10	3.90	2.70	3.30	2.70
7	3.20	3.50	3.00	3.50	2.70	10.45	2.95
8	2.90	8.37	3.50	3.20	2.60	7.20	2.40

Mean daily gage height, in feet, of Catawba River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
9	2.60	7.80	3.55	10.15	2.60	4.60	2.40
10	2.50	5.10	5.40	7.90	2.60	3.40	2.20
11	2.30	4.10	4.30	5.10	2.55	5.50	2.10
12	3.10	7.02	4.90	4.10	2.50	4.40	2.00
13	3.00	5.90	4.80	5.80	2.50	3.50	2.15
14	2.70	4.15	4.80	9.35	2.50	3.00	2.30
15	2.40	3.40	3.50	8.70	2.50	2.80	2.40
16	2.40	3.20	3.25	5.70	2.50	2.60	2.20
17	2.35	10.25	3.10	4.40	2.50	2.50	2.00
18	2.30	9.70	2.95	3.85	2.40	2.50	2.00
19	2.20	5.40	2.85	3.60	2.40	2.45	2.00
20	2.20	3.80	2.80	3.55	2.35	2.40	2.00
21	2.30	3.35	2.70	3.50	2.30	2.70	2.00
22	2.50	3.15	6.45	3.60	2.30	2.40	1.95
23	2.65	2.90	13.30	3.35	2.30	2.90	1.90
24	2.50	2.80	18.00	3.20	2.30	4.20	1.90
25	2.40	2.75	11.40	3.10	2.25	3.00	1.90
26	2.30	2.65	5.70	3.10	2.25	2.50	1.85
27	2.25	2.60	4.10	3.30	2.25	2.80	1.80
28	2.40	3.80	3.80	3.10	2.20	2.60	1.80
29	2.50	.....	3.50	2.90	2.30	2.50	1.80
30	2.60	.....	6.85	2.80	2.20	2.40	2.70
31	2.50	.....	11.30	.....	2.40	.....	2.10

Rating table for Catawba River near Rockhill, S. C., from January 1 to July 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.8	3,100	3.3	6,550	4.8	10,800	6.3	16,450
1.9	3,325	3.4	6,800	4.9	11,150	6.4	16,850
2.0	3,550	3.5	7,050	5.0	11,500	6.5	17,275
2.1	3,775	3.6	7,300	5.1	11,850	6.6	17,700
2.2	4,000	3.7	7,550	5.2	12,200	6.7	18,150
2.3	4,225	3.8	7,800	5.3	12,550	6.8	18,600
2.4	4,450	3.9	8,050	5.4	12,900	6.9	19,050
2.5	4,675	4.0	8,300	5.5	13,275	7.0	19,500
2.6	4,900	4.1	8,600	5.6	13,650	7.5	21,750
2.7	5,125	4.2	8,900	5.7	14,050	8.0	24,000
2.8	5,350	4.3	9,200	5.8	14,450	8.5	26,500
2.9	5,575	4.4	9,500	5.9	14,850	9.0	29,000
3.0	5,800	4.5	9,800	6.0	15,250	9.5	31,500
3.1	6,050	4.6	10,100	6.1	15,650	10.0	34,000
3.2	6,300	4.7	10,450	6.2	16,050	10.5	36,750

Table for 1903 same as 1902. Above 4.6 feet, gage height, 1901 and 1902 rating tables are the same.

Estimated monthly discharge of Catawba River near Rockhill, S. C., for 1903.

[Drainage area, 2,987 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	34,000	3,775	6,728	2.25	2.59
February	35,375	4,000	11,183	3.74	3.89
March	93,000	5,125	15,952	5.34	6.16
April	34,825	5,350	11,518	3.86	4.31
May	5,350	4,000	4,610	1.54	1.78
June	36,470	4,450	7,585	2.54	2.83
July	5,687	3,100	3,883	1.30	1.50

CATAWBA RIVER NEAR MORGANTON, N. C.

The original station was established June 19, 1900, in connection with the hydrographic investigation of the Southern Appalachian area, at which time a wire gage was installed on the highway bridge on the road from Morganton to Hartland. In May, 1901, the river throughout this part of its course rose from 8 to 15 feet higher than ever before known, and the bridge and gage were destroyed. The present station was established May 15, 1903, by E. W. Myers, assisted by B. S. Drane, at the bridge which was built to replace the one carried away by the flood of May, 1901. The station is 1 mile north of Morganton and about 200 yards below the mouth of Upper Creek. The standard chain gage with inclosed scale is attached to the lower chord of the downstream side of the bridge. The zero of the scale is about 94 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 36.95 feet. The gage is read once each day by J. J. Edmundson. Discharge measurements are made from the downstream side of the single-span steel highway bridge to which the gage is attached. The initial point for soundings is the left end of the downstream hand rail. Distances are laid off along this rail and are marked in white paint. The channel is straight for about 200 feet above and for about 600 feet below the station. The current is swift. The right bank is low and overflows to a slight extent on account of erosion, but all water passes beneath the approach to the bridge. The left bank is high, rocky, and wooded. The bed of the stream is rocky, with sand and gravel near the right bank.

Bench mark No. 1 is the left side of the upper surface of the sixth floor beam at the downstream side of the bridge, 13 feet to the right of the zero of the gage. The point is indicated by a spot of white paint and the letters B. M. When the gage reads zero the water surface is 34.77 feet below this point. Bench mark No. 2 is a copper

plug set in cement in a rock on the left bank 24.3 feet back of the initial point for soundings, and is 3 feet downstream from the line of the downstream truss. It is about 1½ feet above the road and is inclosed in a circle of white paint and marked "B. M." Its elevation is 37.37 feet above datum of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Catawba River near Morganton, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 13	E. W. Myers	2.77	2,861
May 5	do	2.04	1,656
Do	do	2.05	1,698
June 25	do	1.93	1,276
Do	do	1.95	1,282
August 21	B. S. Drane	1.77	1,181
Do	do	1.76	1,193
October 28	do	1.16	528
Do	do	1.18	559
December 11	do	1.19	480
Do	do	1.22	493

Mean daily gage height, in feet, of Catawba River near Morganton, N. C., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.45	1.75	1.50	1.55	1.25	1.20	1.20
2		3.45	1.70	1.75	1.45	1.25	1.20	1.20
3		3.25	1.70	1.60	1.35	1.25	1.20	1.20
4		2.45	1.75	2.55	1.35	1.25	1.20	1.20
5		3.00	2.00	2.25	1.30	1.25	2.00	1.20
6	2.00	10.00	2.00	1.50	1.35	1.30	1.55	1.20
7	2.00	5.25	2.15	1.50	1.30	1.50	1.35	1.20
8	1.95	3.60	1.80	1.40	1.45	3.00	1.25	1.20
9	1.95	2.45	1.70	1.35	1.95	1.65	1.25	1.20
10	1.95	6.45	1.65	1.30	1.45	1.40	1.25	1.20
11	1.95	4.00	1.80	1.40	1.40	1.40	1.25	1.20
12	1.90	3.35	2.00	1.60	1.45	1.35	1.20	1.15
13	1.90	2.90	2.40	1.85	1.30	1.35	1.20	1.20
14	2.00	2.60	2.00	1.95	1.35	1.30	1.20	1.25
15	1.95	2.45	1.90	1.80	1.40	1.30	1.20	1.25
16	1.90	2.35	1.80	2.75	1.75	1.30	1.20	1.25
17	1.90	2.30	1.75	2.00	2.15	1.50	1.70	1.25
18	1.90	2.60	1.70	2.00	2.05	1.50	2.20	1.20
19	1.85	2.25	1.70	1.85	1.50	1.40	1.60	1.20
20	1.85	2.20	1.70	1.75	1.45	1.40	1.40	1.40
21	1.80	2.15	1.60	1.85	1.35	1.35	1.30	1.60
22	1.75	2.05	1.50	1.45	1.35	1.35	1.30	1.40
23	1.75	2.80	1.50	1.50	1.30	1.35	1.30	1.30
24	1.75	2.15	1.50	1.50	1.30	1.30	1.30	1.30
25	1.75	2.05	1.50	1.35	1.25	1.30	1.30	1.30

Mean daily gage height, in feet, of Catawba River, etc.—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	1.75	2.00	1.45	1.35	1.30	1.30	1.25	1.30
27	1.80	1.95	1.45	1.30	1.30	1.30	1.25	1.30
28	1.70	.....	1.40	1.00	1.30	1.25	1.20	1.30
29	1.70	2.00	1.60	1.25	1.25	1.20	1.20	1.30
30	2.25	1.80	1.70	1.25	1.25	1.20	1.20	1.25
31	1.95	.....	1.60	1.20	.....	1.25	.....	1.25

Estimated monthly discharge of Catawba River near Morganton, N. C., for 1903.

[Drainage area, 758 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 6–31	1,925	1,026	1,283	1.69	1.63
June	17,040	1,156	3,476	4.59	5.12
July	2,220	702	1,100	1.45	1.67
August	2,902	367	1,028	1.36	1.57
September	1,735	569	770	1.02	1.14
October	3,390	526	735	.97	1.12
November	1,830	526	674	.89	.99
December	908	485	579	.76	.88

Rating table for Catawba River near Morganton, N. C., from May 6 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	367	2.4	2,220	3.8	4,950	5.2	7,680
1.1	444	2.5	2,415	3.9	5,145	5.3	7,875
1.2	526	2.6	2,610	4.0	5,340	5.4	8,070
1.3	612	2.7	2,805	4.1	5,535	5.5	8,265
1.4	702	2.8	3,000	4.2	5,730	5.6	8,460
1.5	800	2.9	3,195	4.3	5,925	5.7	8,655
1.6	908	3.0	3,390	4.4	6,120	5.8	8,850
1.7	1,026	3.1	3,585	4.5	6,315	5.9	9,045
1.8	1,156	3.2	3,780	4.6	6,510	6.0	9,240
1.9	1,300	3.3	3,975	4.7	6,705	6.5	10,215
2.0	1,460	3.4	4,170	4.8	6,900	7.0	11,190
2.1	1,640	3.5	4,365	4.9	7,095		
2.2	1,830	3.6	4,560	5.0	7,290		
2.3	2,025	3.7	4,755	5.1	7,485		

Above 7 feet gage height differences are 195 per tenth.

BROAD RIVER (OF THE CAROLINAS) AT ALSTON, S. C.

This station was established July 3, 1896, by E. W. Myers at the Southern Railroad bridge at Alston, S. C., about 27 miles above Columbia. The standard chain gage is located in the second span from the left end of the bridge. The zero of the scale is 74 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 39.22 feet. The observer is G. M. Heron, a farmer of Alston, S. C., who reads the gage once each day. Discharge measurements are made from the downstream side of the steel through 6-span railway bridge to which the gage is attached. The initial point for soundings is the end of the second span nearest the left bank over the center of the pier. At flood stages some water passes behind this point. The channel above the station is straight, but the current is interrupted by a large island and passes under the bridge at an angle. Below the bridge the channel is straight for about one-half mile. Both banks are high and all water passes beneath the bridge. The bed of the stream is of sand and silt and is slightly shifting. There is but one channel at all stages.

Bench mark No. 1 is a point on the right side of the downstream end of the fifth floor beam from the left end of the second span from the left end of the bridge. It is marked in white paint and is indicated by the letters B. M. When the gage reads zero the water surface is 36.44 feet below this point. Bench mark No. 2 is a standard copper bolt set in rock on the left bank on the hillside 50 yards from the river and 52 feet downstream from the center line of the trestle approach to the bridge and is 21.2 feet from the corner of the pump house. The rock is white and the bench mark is under a small china tree. This bench mark is 9.85 feet below the bench mark on the bridge, making its elevation 26.59 feet above the gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Broad River at Alston, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 23	E. W. Myers	19.85	71,138
April 17	E. C. Murphy	7.74	15,058
June 24	B. S. Drane	6.20	10,591
August 6	J. M. Giles	5.58	8,259
Do	M. R. Hall	5.58	7,954
September 10	J. M. Giles	4.86	7,218
October 22	do	3.45	3,219
December 10	do	3.75	3,437

Mean daily gage height, in feet, of Broad River at Alston, S. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.60	4.90	15.12	13.50	5.20	5.60	4.90	3.80	3.60	3.30	3.40	3.20
2	4.25	4.65	11.25	10.00	5.10	7.55	4.40	3.90	7.10	3.30	3.40	3.60
3	12.60	4.45	7.90	7.90	5.00	8.70	4.20	6.60	4.50	3.30	3.50	3.50
4	12.72	7.25	6.55	7.20	5.30	6.65	4.30	4.70	4.20	3.25	3.90	3.60
5	9.85	10.00	6.25	7.00	5.00	7.30	4.50	5.50	4.00	3.20	4.50	3.60
6	7.75	8.20	5.80	6.40	5.10	13.60	4.70	5.70	3.60	3.10	5.60	3.60
7	6.55	7.55	5.75	6.20	5.00	27.20	5.10	5.50	3.60	3.40	4.50	3.60
8	5.70	18.30	7.12	6.00	4.90	26.70	4.80	3.90	3.20	3.50	4.00	3.70
9	5.30	18.00	6.90	8.20	4.90	17.30	4.30	3.60	3.40	4.00	3.70	3.80
10	5.05	11.85	7.83	10.20	4.80	9.90	4.10	3.60	4.80	3.90	3.50	3.70
11	4.85	11.82	6.50	7.40	4.80	8.90	4.00	3.20	4.00	3.70	3.70	3.70
12	7.62	15.97	8.55	6.60	4.60	10.20	4.00	4.20	4.20	3.40	3.60	3.70
13	7.40	13.65	8.45	6.30	4.80	7.60	4.20	3.70	3.40	3.20	3.50	3.60
14	6.05	9.65	7.35	15.75	4.90	6.20	4.90	4.40	3.30	3.40	3.50	3.70
15	5.45	7.25	6.53	14.95	5.10	5.80	4.50	5.70	3.10	3.40	3.50	3.50
16	5.20	6.30	6.00	11.05	4.90	5.40	4.20	7.15	3.60	3.30	3.40	3.80
17	4.90	15.75	5.80	8.40	4.70	5.20	3.90	8.60	7.00	3.60	3.30	3.70
18	4.85	17.15	5.50	7.15	4.60	5.00	3.80	7.10	6.20	4.60	3.40	3.70
19	4.60	11.50	5.37	6.70	4.50	5.00	3.80	8.20	4.70	3.80	4.20	3.80
20	4.45	8.82	5.43	6.50	4.40	5.00	3.80	8.40	3.90	3.40	3.90	3.60
21	4.80	6.80	8.25	6.10	4.40	4.80	3.50	6.20	3.70	3.50	3.60	3.70
22	5.25	6.30	13.95	6.40	4.30	4.90	3.60	4.60	3.40	3.40	3.50	3.60
23	5.20	5.75	20.60	5.90	4.20	5.20	3.50	4.40	3.50	3.40	3.60	4.00
24	4.70	5.60	25.10	5.80	4.20	6.00	3.50	4.20	3.50	3.70	3.40	3.80
25	4.45	5.35	19.00	5.60	4.30	5.50	3.40	3.70	3.50	3.70	3.70	3.80
26	4.60	5.15	10.70	5.40	4.00	4.90	3.40	3.70	3.40	3.40	3.60	4.20
27	4.60	4.95	7.90	6.80	4.10	5.30	3.30	3.50	3.30	3.20	3.50	4.10
28	4.65	11.17	7.20	5.80	4.20	4.80	3.10	3.50	3.40	3.40	3.50	4.00
29	6.05	.....	7.95	5.40	7.10	5.70	3.30	3.50	3.10	3.40	3.50	3.70
30	5.70	.....	17.40	5.30	6.60	5.70	4.00	3.30	3.30	3.30	3.50	3.80
31	5.25	.....	19.05	.....	5.30	.....	4.00	3.80	.....	3.30	.....	3.70

Rating table for Broad River at Alston, S. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.0	2,250	5.5	8,225	10.0	22,150	15.0	43,300
3.1	2,420	5.6	8,500	10.2	22,800	15.2	44,400
3.2	2,590	5.7	8,775	10.4	23,500	15.4	45,500
3.3	2,770	5.8	9,050	10.6	24,200	15.6	46,650
3.4	2,960	5.9	9,325	10.8	24,900	15.8	47,800
3.5	3,150	6.0	9,600	11.0	25,650	16.0	48,950
3.6	3,350	6.2	10,200	11.2	26,400	16.2	50,100
3.7	3,560	6.4	10,800	11.4	27,150	16.4	51,250
3.8	3,780	6.6	11,400	11.6	27,900	16.6	52,450
3.9	4,010	6.8	12,000	11.8	28,700	16.8	53,650
4.0	4,250	7.0	12,600	12.0	29,500	17.0	54,850
4.1	4,500	7.2	13,200	12.2	30,300	17.2	56,150
4.2	4,750	7.4	13,800	12.4	31,150	17.4	57,500
4.3	5,000	7.6	14,400	12.6	32,000	17.6	58,900
4.4	5,250	7.8	15,000	12.8	32,850	17.8	60,300
4.5	5,500	8.0	15,650	13.0	33,700	18.0	61,700
4.6	5,750	8.2	16,300	13.2	34,550	18.2	63,100
4.7	6,025	8.4	16,950	13.4	35,450	18.4	64,500
4.8	6,300	8.6	17,600	13.6	36,350	18.6	66,000
4.9	6,575	8.8	18,250	13.8	37,250	18.8	67,500
5.0	6,850	9.0	18,900	14.0	38,200	19.0	69,000
5.1	7,125	9.2	19,550	14.2	39,150	19.2	70,500
5.2	7,400	9.4	20,200	14.4	40,150		
5.3	7,675	9.6	20,850	14.6	41,200		
5.4	7,950	9.8	21,500	14.8	42,250		

Differences above 19 feet gage height, 750 per tenth. Table not well determined above 8 feet gage height.

Estimated monthly discharge of Broad River at Alston, S. C., for 1903.

[Drainage area, 4,609 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	32,425	4,875	9,882	2.14	2.47
February	63,800	5,375	22,647	4.91	5.11
March	114,750	7,812	25,601	5.55	6.40
April	47,512	7,675	15,578	3.38	3.77
May	12,900	4,250	6,474	1.40	1.61
June	130,500	6,300	20,836	4.52	5.04
July	7,125	2,420	4,407	.96	1.11
August	17,600	2,590	6,837	1.48	1.71
September	12,900	2,420	4,416	.96	1.07
October	5,750	2,420	3,136	.68	.78
November	8,500	2,770	3,656	.79	.88
December	4,750	2,590	3,604	.78	.90
The year	130,500	2,420	10,589	2.30	30.85

SALUDA RIVER NEAR WATERLOO, S. C.

This station was established by E. W. Myers, August 30, 1896. It is located at the Charleston and Western Carolina Railroad bridge between Coronaca and Waterloo, 3 miles from Waterloo and 9 miles from Greenwood. It is 1 mile below the mouth of Reedy River. The standard chain gage is on the downstream side of the bridge, on the span next the left bank, in the seventh panel. The zero of the gage is 5.4 feet to the right of the panel point. The length of the chain from the end of the weight to the marker is 45.65 feet. July 20, 1902, the gage was changed so as to increase the readings 1.5 feet. The 1902 gage heights were all referred to the new datum. The gage is read once each day by R. N. Cunningham, storekeeper and farmer at Waterloo, S. C. Discharge measurements are made from the railway bridge and its approaches. The bridge is a steel through bridge of two spans about 125 feet each, with wooden trestles 600 feet long on the left bank and 200 feet on the right bank. The initial point for soundings is the end of the guard rail of the trestle on the left bank. The channel is straight for about 600 feet above and below the station. Both banks are low and wooded and are subject to overflow, but all water passes beneath the bridge and its approaches. The bed of the stream is sandy and muddy and is slightly shifting.

There is but one channel at all stages. Its width at low water is 250 feet, the channel is broken by one pier, and the velocity is moderate.

Bench mark No. 1 is a point on the top surface of the outer eye bar of the lower chord of the downstream side of the bridge, at a point opposite the zero of the gage. The point is indicated by a spot of white paint and by the letters "B. M." When the gage reads zero the water surface is 43.59 feet below this bench mark. Bench mark No. 2 is a copper bolt set in a granite bowlder on the right bank of the stream 470 feet from the end of the trestle (measured along the railroad track) and 50 feet upstream from the center of the track. Its elevation is 61.44 feet above gage datum. The rock is near two small persimmon trees.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Saluda River near Waterloo, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 23	E. W. Myers	17.40	12,968
April 18	E. C. Murphy	9.40	3,481
Do	B. S. Drane	9.60	3,739
April 21	do	9.20	3,747
June 25	do	6.76	1,375
Do	do	7.03	1,527
August 5	J. M. Giles	6.88	1,542
Do	M. R. Hall	6.88	1,458
September 9	J. M. Giles	6.38	1,245
October 21	do	6.28	1,176
December 9	do	5.90	883

Mean daily gage height, in feet, of Saluda River near Waterloo, S. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.45	7.90	14.70	11.20	7.75	9.85	7.15	6.85	5.55	5.50	5.30	6.00
2	7.20	6.20	12.70	9.80	7.80	10.40	6.55	6.85	5.50	5.55	5.50	5.80
3	11.40	6.60	9.90	9.45	7.85	8.40	6.90	7.15	5.50	6.25	7.90	6.10
4	10.90	10.60	9.20	9.05	8.20	7.75	18.25	6.20	5.55	5.20	7.10	5.80
5	9.10	12.50	8.90	9.30	8.05	12.15	5.70	7.00	5.55	5.30	8.45	5.75
6	8.05	9.60	9.00	8.75	7.90	14.00	7.95	7.15	6.35	5.30	6.70	5.55
7	7.60	11.00	8.70	8.50	7.90	19.25	7.45	6.20	4.90	5.60	6.90	4.75
8	7.40	19.60	9.00	9.90	7.70	22.35	6.85	6.55	5.40	5.75	6.60	5.95
9	6.80	17.60	9.70	10.80	7.10	14.45	6.25	6.35	5.60	5.55	5.65	6.05
10	7.10	11.70	9.80	9.20	8.30	10.30	6.25	5.75	8.05	6.25	6.10	5.90
11	8.90	13.30	9.70	9.40	6.05	11.20	6.90	5.70	6.10	5.60	6.00	5.90
12	9.30	17.05	11.90	9.60	7.40	10.10	7.30	6.05	6.30	4.95	5.80	6.00

Mean daily gage height, in feet, of Saluda River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	8.70	15.30	12.50	11.00	7.60	9.15	7.60	6.15	5.95	5.50	5.85	5.70
14	7.75	10.85	9.90	17.70	7.25	8.55	8.00	5.85	5.05	5.55	6.55	4.90
15	7.30	9.95	9.50	16.45	7.60	8.35	7.25	6.70	5.45	5.60	5.70	6.15
16	7.30	8.80	9.00	11.20	7.15	8.25	6.45	7.40	6.55	5.55	5.45	6.00
17	7.20	15.80	8.70	9.90	7.55	8.20	6.10	7.30	5.90	6.45	6.50	6.35
18	7.60	16.20	8.50	9.40	5.90	7.90	6.05	9.90	6.05	5.55	6.15	5.65
19	6.10	13.60	8.20	9.65	6.85	7.85	7.95	11.00	6.60	5.35	5.15	5.90
20	6.90	9.70	8.30	.....	7.70	7.15	5.15	7.60	5.75	5.55	5.95	5.60
21	6.45	9.30	8.40	.....	6.65	7.55	5.65	6.55	5.60	6.35	6.10	4.90
22	6.60	8.85	11.00	.....	6.60	7.15	5.95	7.00	5.45	5.55	5.70	6.05
23	6.40	8.55	17.40	.....	6.55	8.60	5.85	6.65	5.50	6.20	5.45	6.00
24	6.70	8.40	16.30	.....	7.05	7.95	5.75	5.85	5.60	5.65	6.00	5.95
25	7.40	7.45	15.20	8.30	6.05	7.10	6.00	5.75	5.40	5.25	5.85	5.75
26	6.20	8.00	10.30	9.10	9.25	7.20	6.50	5.70	5.50	5.10	5.85	5.50
27	6.90	8.50	9.45	8.40	6.20	7.40	5.70	5.45	5.25	5.55	4.80	6.15
28	6.50	12.00	9.05	8.35	8.55	7.95	6.45	5.45	5.10	5.70	6.55	5.85
29	8.40	.....	11.90	8.15	7.95	8.10	6.25	5.60	5.40	5.70	5.85	5.95
30	7.10	.....	15.50	8.10	7.50	8.00	6.00	6.25	5.45	5.70	5.25	5.90
31	7.40	.....	14.40	.....	7.95	.....	7.05	4.85	.....	6.30	.....	5.65

Rating table for Saluda River near Waterloo, S. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.7	386	6.1	1,040	7.5	1,890	8.9	2,990
4.8	423	6.2	1,095	7.6	1,960	9.0	3,085
4.9	461	6.3	1,150	7.7	2,030	9.1	3,180
5.0	500	6.4	1,205	7.8	2,100	9.2	3,280
5.1	540	6.5	1,260	7.9	2,175	9.3	3,380
5.2	582	6.6	1,320	8.0	2,250	9.4	3,485
5.3	626	6.7	1,380	8.1	2,325	9.5	3,590
5.4	672	6.8	1,440	8.2	2,400	9.6	3,700
5.5	720	6.9	1,500	8.3	2,480	9.7	3,810
5.6	770	7.0	1,560	8.4	2,560	9.8	3,920
5.7	822	7.1	1,625	8.5	2,640	9.9	4,035
5.8	875	7.2	1,690	8.6	2,725	10.0	4,150
5.9	930	7.3	1,755	8.7	2,810	10.1	4,270
6.0	985	7.4	1,820	8.8	2,900		

Above gage height 10 feet, differences 120 per tenth.

Estimated monthly discharge of Saluda River near Waterloo, S. C., for 1903.

[Drainage area, 1,056 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	5,830	1,040	2,074	1.96	2.26
February	15,670	1,095	5,858	5.55	5.78
March	13,030	2,400	5,273	4.99	5.75
April [a]	13,390	2,325	4,303	4.07	3.78
May	2,682	930	1,798	1.70	1.96
June	18,970	1,625	4,222	4.00	4.46
July	14,050	561	1,748	1.66	1.91
August	5,350	442	1,417	1.34	1.54
September	2,287	461	856	.81	.90
October	1,232	480	802	.76	.88
November	2,600	423	1,072	1.02	1.14
December	1,177	404	882	.84	.97

[a] April 23-24 missing.

MISCELLANEOUS MEASUREMENTS IN SANTEE RIVER DRAINAGE BASIN.

Wateree River.—Measurements were made at Camden, S. C. The gage heights were measured by the United States Weather Bureau gage.

Discharge measurements of Wateree River at Camden, S. C., in 1903.

Date.	Gage height.	Discharge.
	Feet.	*Second-feet.*
May 26	8.35	3,929
June 23	10.75	6,222
Do	10.90	6,694
August 7	9.15	6,285

Catawba River.—Measurements were made on this stream at the Lancaster and Chester Railroad bridge near Fort Lawn, S. C. The bench mark is the top of first crossbeam from second pier from left bank of the railroad bridge. It has an elevation of 33 feet above gage datum.

Discharge measurements of Catawba River near Fort Lawn, S. C., in 1903.

Date.	Gage height.	Discharge.
	Feet.	*Second-feet.*
August 8	3.98	5,070
September 12	2.90	3,137
October 24	2.93	3,107
December 12	2.45	2,108

At Mount Holly, N. C., Catawba River was discharging 1,192 second-feet on November 13.

At Belmont, N. C., the stream was discharging 1,393 second-feet on December 3, when the water surface was 27.48 feet below the bench mark, which is the top of inside bar of lower downstream chord at first crossbeam from third pier from left bank.

John River.—At Morganton, N. C., this stream had a discharge of 1,192 second-feet on February 13, 1903.

Broad River.—At the Seaboard Air Line bridge near Carlisle, S. C., this stream was discharging 3,663 second-feet on August 11, 1903, when the water surface was 34.16 feet below the top of the first crossbeam of the second span from right bank.

Tiger River.—This stream was measured at the Seaboard Air Line bridge near Delta, S. C. The bench mark is the top of the downstream end of the second crossbeam from the right bank.

Discharge measurements of Tiger River near Delta, S. C.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
August 12	32.52	921
October 27	34.25	411

Enoree River.—This stream was measured at the Seaboard Air Line bridge near Whitmire, S. C. The bench mark is the top of the girder under cross-ties at a point 50 feet from end of bridge at right bank downstream.

Discharge measurements of Enoree River near Whitmire, S. C.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
August 13	54.50	470
October 27	54.40	293

A mill about one-half mile below prevents rating at this place.

SAVANNAH RIVER DRAINAGE BASIN.

Savannah River is formed by the junction of Tugalo and Seneca rivers, which unite about 100 miles above Augusta, Ga. It flows in a southeasterly direction, forming the boundary between Georgia and South Carolina, and empties into the Atlantic Ocean near Savannah, Ga. It is navigable up to Augusta, which is at the fall line.

Seneca River is formed by the junction of Little and Keowee rivers, about 5 miles northeast of Seneca, S. C. Both of these tributaries rise in the Blue Ridge in North Carolina and the northwestern part of South Carolina.

Tugalo River is formed by the junction of Chattooga and Tallulah rivers, which join at the western corner of Oconee County, S. C. It flows in a southeasterly direction, and is a part of the boundary between Georgia and South Carolina. Chattooga River rises in Jackson County, N. C., and flows in a southwesterly direction along the boundary between Georgia and South Carolina. Tallulah River rises in Macon County, N. C., and the northwestern part of Rabun County, Ga., and flows in a southeastly direction. Parts of its course are cut through the solid rock for hundreds of feet, forming canyons and steep bluffs. Throughout its entire length the fall is very great, and at Tallulah Falls the stream drops more than 500 feet in a short distance.

Broad River joins the Savannah at the southeast corner of Elbert County, Ga. It rises in Habersham and Banks counties, and flows in a southeastly direction to the southeast corner of Madison County, Ga., where the South Fork joins it. From there it flows east to Savannah River. Its drainage is from a rolling country, and there is a considerable amount of fall at various points. At Anthony Shoals the fall is more than 50 feet in a short distance. Above Augusta, Ga., there is much fall, which can be developed for water power. With exception of the large plant at Augusta, very little of this is being used.

The United States Geological Survey during 1903 maintained the following stations in this basin under the direction of M. R. Hall: On the Savannah, at Augusta and Calhoun Falls; on the Broad (of

Georgia), at Carlton, Ga.; on the Seneca, near Clemson College, S. C.; and on the Tugalo, near Fort Madison, S. C.

SAVANNAH RIVER AT AUGUSTA, GA.

Observations of river height have been maintained since 1875 by the city of Augusta at the city highway bridge. The results have been printed in a volume entitled "Stages of Water at River Stations," prepared by the United States Weather Bureau. Those for 1875 to 1889 are given in part 3, those for 1890 to 1892 in part 4, and those for 1893 to 1895 in part 5 of this publication. The gage consists of a vertical timber fastened to the pier and graduated to feet and inches. Readings are made four times a day by J. M. Youngblood, keeper of the city bridge, usually at 6 a. m., 12 m., 6 p. m., and 9 p. m. The 6 a. m. readings are those used by the Weather Bureau, but in the publications of the United States Geological Survey since 1900 the average of all four of the daily readings is used and is reduced to feet and tenths of feet.

Discharge measurements are made from the North Augusta highway bridge at Thirteenth street in the city of Augusta, while the city gage is located at the city bridge at Fifth street, which is about a mile below.

The North Augusta bridge consists of three iron spans, 208 feet each, with 319 feet of wooden approach on the right bank and 259 feet on the left. The channel is straight for a long distance above and below and is about 560 feet wide at low water. The banks are high, but will overflow at times under a part of the length of the approaches and, at very high stages, for a long distance on either side of the river beyond the ends of the bridge. The bed of the river is sandy and undergoes considerable change. The current is swift. Measurements are made from the downstream side of the bridge, and the initial point is the end of the iron bridge at the right bank on the downstream side.

The gage at the city bridge, 1 mile below the measuring station, is a heavy vertical timber, graduated to feet and inches, and is bolted to the first bridge pier which is in the water. It is on the side of the pier near the upstream corner, facing the right bank. The zero of the gage is the datum of all the city levels, and any city bench mark can therefore be used. A point is established on the North Augusta bridge from which to measure down with a steel tape. This is the top of the downstream end of the second iron crossbeam from the right-bank end of the bridge, and at ordinary stages it is 48.60 feet above water, less the reading of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Savannah River at Augusta, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 10	M. R. Hall	15.10	17,741
September 29	do	7.13	3,831
December 3	W. E. Hall	7.20	3,898

Mean daily gage height, in feet, of Savannah River at Augusta, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.70	10.20	26.70	23.40	10.60	11.00	9.70	9.00	7.40	7.10	6.80	7.00
2	9.40	9.60	24.00	18.70	10.50	16.30	9.40	8.90	7.20	7.00	7.20	7.20
3	11.20	9.70	18.40	16.10	10.50	20.00	9.00	12.00	7.30	7.00	8.30	7.20
4	13.80	10.80	14.90	15.20	10.60	15.30	9.50	13.60	7.30	6.90	9.10	7.10
5	13.90	18.50	13.90	14.60	12.40	13.20	9.60	11.70	7.40	7.10	9.10	7.00
6	12.20	18.20	13.70	13.90	11.30	19.90	10.60	10.60	7.20	6.90	9.40	7.00
7	10.70	14.60	13.70	13.00	10.70	24.70	10.00	9.50	7.10	7.10	8.80	7.10
8	9.90	30.70	13.30	13.30	10.50	25.50	10.10	8.60	7.20	7.10	8.60	7.20
9	9.50	33.00	15.00	16.80	10.50	17.70	9.50	8.10	7.30	7.20	7.80	7.30
10	9.20	28.70	15.10	17.50	10.40	15.60	9.20	8.10	7.20	7.50	7.60	7.40
11	9.20	24.10	14.90	14.90	10.40	16.10	9.20	8.10	8.30	7.40	7.60	7.40
12	11.70	28.40	18.20	13.30	10.00	16.10	9.90	10.00	7.80	7.30	7.50	7.40
13	14.10	26.50	19.00	13.10	10.00	15.00	10.00	9.10	7.20	7.00	7.50	7.10
14	12.20	20.40	15.30	20.40	10.40	12.10	13.20	8.30	7.40	7.00	7.50	7.20
15	10.60	16.00	13.80	23.60	11.20	11.20	13.40	9.50	8.20	6.90	7.30	7.40
16	9.90	14.40	13.20	17.80	12.90	10.60	11.00	9.80	9.40	6.90	7.30	7.60
17	9.60	25.90	12.70	14.60	11.70	10.10	9.50	10.30	11.90	7.30	7.80	7.50
18	9.30	29.10	12.20	13.60	10.50	9.80	8.90	9.90	10.80	9.20	7.50	7.30
19	9.20	23.40	11.90	12.70	9.90	9.70	8.70	17.70	9.00	8.40	7.60	7.20
20	9.10	18.60	11.80	12.50	9.60	9.60	8.40	14.80	8.10	8.20	7.80	7.00
21	9.10	14.60	12.00	12.30	9.50	9.80	8.20	11.30	8.20	7.60	7.70	7.10
22	9.20	13.10	18.20	12.30	9.40	10.40	8.20	9.90	7.60	7.40	7.30	7.40
23	9.00	12.60	25.50	11.90	9.50	9.80	8.10	8.70	7.50	7.00	7.30	7.90
24	9.00	12.10	29.40	11.50	9.20	9.40	8.10	8.40	7.40	7.10	7.30	7.60
25	9.10	11.70	28.60	11.10	9.20	9.40	8.00	8.30	7.40	6.80	7.40	7.40
26	9.90	11.50	22.50	11.40	9.00	9.30	7.60	8.00	7.40	7.00	7.30	7.70
27	10.20	11.60	17.10	11.70	8.70	9.70	7.90	7.80	7.20	7.00	7.30	8.00
28	10.90	16.90	15.20	11.50	8.80	10.70	8.00	7.60	7.20	6.90	7.10	8.00
29	10.90	.....	14.80	11.00	9.40	12.90	7.70	7.60	7.10	6.90	7.00	7.60
30	11.80	.....	25.30	10.70	9.60	11.00	8.00	7.50	7.10	7.00	7.10	7.50
31	11.20	.....	27.30	.....	9.70	.....	8.70	7.50	.....	7.00	.....	7.60

Rating table for Savannah River at Augusta, Ga., for 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.8	3,400	10.8	11,200	14.8	19,660	23.0	45,800
7.0	3,740	11.0	11,600	15.0	20,100	23.5	48,900
7.2	4,100	11.2	12,020	15.2	20,560	24.0	52,000
7.4	4,460	11.4	12,440	15.4	21,020	24.5	56,000
7.6	4,840	11.6	12,860	15.6	21,480	25.0	60,000
7.8	5,220	11.8	13,280	15.8	21,940	25.5	64,400
8.0	5,600	12.0	13,700	16.0	22,400	26.0	68,800
8.2	6,000	12.2	14,120	16.5	23,600	26.5	73,200
8.4	6,400	12.4	14,540	17.0	24,800	27.0	77,600
8.6	6,800	12.6	14,960	17.5	26,050	27.5	82,000
8.8	7,200	12.8	15,380	18.0	27,300	28.0	86,400
9.0	7,600	13.0	15,800	18.5	28,700	28.5	90,800
9.2	8,000	13.2	16,220	19.0	30,100	29.0	95,200
9.4	8,400	13.4	16,640	19.5	31,700	29.5	99,600
9.6	8,800	13.6	17,060	20.0	33,300	30.0	104,000
9.8	9,200	13.8	17,480	20.5	35,100	30.5	108,400
10.0	9,600	14.0	17,900	21.0	36,900	31.0	112,800
10.2	10,000	14.2	18,340	21.5	38,950	31.5	117,200
10.4	10,400	14.4	18,780	22.0	41,000	32.0	121,600
10.6	10,800	14.6	19,220	22.5	43,400	33.0	130,400

Table same as for 1902.

Estimated monthly discharge of Savannah River at Augusta, Ga., for 1903.

[Drainage area, 7,294 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	18,120	7,600	10,591	1.45	1.67
February	130,400	8,800	39,580	5.42	5.64
March	98,720	13,280	32,924	4.51	5.20
April	49,520	11,000	19,907	2.73	3.05
May	15,590	7,000	10,040	1.38	1.59
June	64,400	8,200	18,265	2.50	2.79
July	16,640	4,840	8,153	1.12	1.29
August	26,550	4,650	9,054	1.24	1.43
September	13,490	3,920	5,315	.73	.81
October	8,000	3,400	4,179	.57	.66
November	8,400	3,400	4,979	.68	.76
December	5,600	3,740	4,405	.60	.69
The year	130,400	3,400	13,949	1.91	25.58

SAVANNAH RIVER NEAR CALHOUN FALLS, S. C.

Systematic measurements were begun at this point August 4, 1896, in order to determine the value of the water powers on this stream. The station is located at the Seaboard Air Line Railroad bridge, 3 miles west of Calhoun Falls, S. C., above the mouth of Beaver Dam Creek and about one-fourth mile below the mouth of Rocky River. The station is at the head of Trotters Shoal. The boxed chain gage is bolted to the downstream guard rail with the bottom resting on ties. The center of the pulley is 185 feet from the initial point for soundings. The length of the chain from the index to the end of weight is 57.10 feet. The observer is Peter J. Pfeiffer, who reads the gage once daily. The station is also used by the United States Weather Bureau, which pays the gage reader. Discharge measurements are made from the upstream side of the railroad bridge to which the gage is attached. This bridge consists of one short span, 175 feet in length, across the east channel and three spans of 155 feet each across the west, or main, channel. These two sections are connected by 875 feet of wooden trestle, from 35 to 45 feet high, which crosses the island between the two channels. The base of the rail is about 54 feet above low water. The initial point for soundings is the left-bank end of the iron bridge on the upstream side. A separate initial point has been used for each channel, the description being the same in both cases. Distances are marked with white paint on the upstream guard rail. The river is divided into two channels by a large island containing several hundred acres. Both channels are slightly curved for about 2,000 feet above the bridge and are straight for about 500 feet below. The west channel, which is the main river, is sluggish only at low water. It has a rough and rocky bed, and in places the current is irregular.

The east channel is a good section, but has a low velocity. The right bank of the west channel and the left bank of the east channel are high and wooded and are not liable to overflow. The island between the channels is nearly covered at extreme high water. At low water the east channel is 150 feet wide and from 3 to 4 feet deep. The main channel is about 400 feet wide and from 2 to 8 feet deep.

Bench mark No. 1 is the top of the iron girder under the cross-ties of the downstream side of the bridge at a point 40 feet west of the second pier from the east end of the bridge. Its elevation is 54 feet above the gage datum. Bench mark No. 2 is the top of the capstone of the east pier of the east channel bridge. The upstream side of this pier is 29.87 feet above gage datum. Bench mark No. 3 is a copper plug set in solid rock on the east bank of the east channel, 15 feet from the edge of the water and 110 feet upstream from the center of the railroad track. Its elevation is 14.38 feet above gage datum. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Savannah River near Calhoun Falls, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 20	J. M. Giles	4.15	9,769
May 7	do	3.60	7,103
June 10	do	4.75	10,904
August 13	do	2.80	3,823
September 15	do	2.52	3,209
October 28	do	2.33	2,534
December 8	do	2.12	2,098

Mean daily gage height, in feet, of Savannah River near Calhoun Falls, S. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.00	4.20	10.40	5.20	3.80	3.60	3.50	3.10	2.90	2.60	2.30	2.00
2	4.00	3.80	7.10	4.50	3.70	5.50	3.50	3.00	2.80	2.50	2.20	2.10
3	4.40	3.90	4.90	4.00	3.70	4.40	3.00	3.00	2.80	2.50	2.20	2.10
4	4.40	6.30	4.40	3.90	4.00	4.60	3.90	3.10	2.80	2.40	2.30	2.20
5	4.20	8.10	4.20	4.00	3.90	4.80	3.70	3.20	2.70	2.40	2.60	2.20
6	4.10	6.40	4.10	3.90	3.70	7.00	3.80	3.40	2.70	2.40	2.50	2.20
7	4.10	5.90	4.10	3.90	3.60	15.30	4.80	3.20	2.60	2.50	2.30	2.20
8	4.00	12.70	4.00	4.00	3.50	8.00	4.00	3.10	2.60	2.50	2.20	2.20
9	3.90	9.40	4.30	5.90	3.50	4.90	4.10	3.00	2.50	2.70	2.20	2.20
10	3.90	5.30	4.20	4.50	3.50	4.00	3.90	3.00	3.00	2.60	2.20	2.30
11	4.10	7.30	4.00	4.10	3.40	3.50	4.00	3.10	2.90	2.60	2.10	2.20
12	4.40	11.20	6.50	4.00	3.40	4.00	4.10	3.20	2.80	2.50	2.10	2.20
13	4.30	6.40	5.90	5.10	3.30	3.80	4.00	3.30	2.60	2.50	2.20	2.30
14	4.10	4.60	4.60	12.90	3.30	3.70	4.20	3.40	2.70	2.40	2.20	2.20
15	3.90	4.40	4.40	9.50	3.40	3.60	4.00	3.20	3.40	2.40	2.10	2.20
16	3.80	5.30	4.40	5.00	3.50	3.50	3.80	3.10	4.20	2.50	2.10	2.10
17	3.70	9.50	4.30	5.40	3.40	3.50	3.70	3.50	4.00	2.60	2.10	2.10
18	3.60	8.40	4.20	5.00	3.30	3.40	3.50	5.50	3.50	3.00	2.20	2.20
19	3.60	6.60	4.20	5.00	3.40	3.20	3.30	6.90	3.20	2.80	2.20	2.20
20	3.60	5.40	4.30	4.90	3.40	3.00	3.20	4.50	3.00	2.60	2.70	2.30
21	3.60	4.90	4.50	4.90	3.30	3.20	3.10	4.00	3.00	2.50	2.40	2.40
22	3.70	4.50	5.90	4.80	3.30	3.10	3.00	3.70	2.90	2.40	2.30	2.30
23	3.60	4.30	11.10	4.70	3.20	3.00	3.00	3.30	2.90	2.40	2.20	2.20
24	3.50	4.10	14.50	4.50	3.20	3.10	3.10	3.10	2.80	2.30	2.20	2.20
25	3.30	4.00	8.70	4.30	3.10	3.00	2.90	3.10	2.80	2.20	2.10	2.20
26	3.20	3.70	6.90	4.00	3.00	3.00	2.90	3.00	2.80	2.20	2.10	2.10
27	3.10	3.80	4.70	3.90	3.00	3.20	2.90	3.00	2.70	2.10	2.00	2.20
28	3.30	7.00	4.40	3.90	3.10	3.50	2.80	2.90	2.70	2.20	2.00	2.20
29	3.40	.....	4.90	3.80	3.10	4.00	2.80	2.90	2.70	2.10	2.00	2.20
30	4.30	.....	9.10	3.80	3.40	3.60	2.90	3.00	2.60	2.10	2.00	2.10
31	3.30	.....	7.50	.....	3.50	.....	3.00	2.90	.....	2.30	.....	2.10

Rating table for Savannah River near Calhoun Falls, S. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	1,870	3.0	4,640	4.0	8,470	5.0	12,600
2.1	2,050	3.1	5,010	4.1	8,860	5.5	14,775
2.2	2,250	3.2	5,390	4.2	9,260	6.0	16,950
2.3	2,470	3.3	5,770	4.3	9,660	6.5	19,125
2.4	2,710	3.4	6,150	4.4	10,060	7.0	21,300
2.5	2,980	3.5	6,530	4.5	10,470	7.5	23,475
2.6	3,280	3.6	6,910	4.6	10,890	8.0	25,650
2.7	3,600	3.7	7,300	4.7	11,310		
2.8	3,930	3.8	7,690	4.8	11,740		
2.9	4,280	3.9	8,080	4.9	12,170		

Table not well determined above 4.75 feet gage height. Above 5 feet same as 1901 and 1902. Tangent at 8 feet. Differences above 8 feet, 435 per tenth.

Estimated monthly discharge of Savannah River near Calhoun Falls, S. C., for 1903.

[Drainage area, 2,712 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	10,060	5,010	7,777	2.87	3.31
February	46,095	7,300	17,551	6.47	6.74
March	53,925	8,470	16,244	5.99	6.90
April	46,965	7,690	12,325	4.54	5.07
May	8,470	4,640	6,216	2.29	2.64
June	57,405	4,640	10,071	3.71	4.14
July	11,740	3,930	6,623	2.44	2.81
August	20,865	4,280	6,265	2.31	2.66
September	9,260	2,980	4,402	1.62	1.81
October	4,640	2,050	2,878	1.06	1.22
November	3,600	1,870	2,301	.85	.95
December	2,710	1,870	2,170	.80	.92
The year	57,405	1,870	7,902	2.91	39.17

BROAD RIVER (OF GEORGIA) NEAR CARLTON, GA.

This station was established May 27, 1897, by M. R. Hall. The gage is now maintained and the observer paid by the United States Weather Bureau. The station is located at the Seaboard Air Line Railroad bridge 3 miles east of Carlton, Ga., and 2 miles above the mouth of the South Fork. The boxed chain gage is bolted to the guard rail with its bottom resting on the upstream end of the cross-ties. The center of the pulley is 39.5 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 54 feet. The observer is S. P. Powers, jr., who reads the gage once daily. Discharge measurements are made from the upstream side of the railway bridge to which the gage is attached. This is an iron deck bridge in two spans of 125 feet each, with trestle approaches 340 feet long on the left bank and 50 feet long on the right bank. The base of the rail of the track is about 51 feet above low water. The initial point for soundings is the end of the iron bridge on the right bank upstream side. The channel above and below the station is straight for 500 feet. The right bank is high and wooded and is not liable to overflow. The left bank is low for about 400 feet and is then high and rocky. It overflows at a gage height of about 16 feet. The bed of the stream is of sand and gravel and is somewhat changeable.

Bench mark No. 1 is the top of the upstream iron girder under the cross-ties at a point about 40 feet from the initial point for soundings. Its elevation is 51 feet above gage datum. Bench mark No. 2 is the top of the capstone of the right bank pier at a point under the upstream side of the end of the bridge. Its elevation is 30.78 feet above the gage datum. Bench mark No. 3 is a copper plug set in solid rock in the railroad cut 1,135 feet from the west end of the iron bridge, 11 feet north of the center of the track, and at about the same elevation as the bottom of the cross-ties. Its elevation above gage datum is 57.67 feet. Gage datum is 384 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Broad River near Carlton, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 21	J. M. Giles	4.55	2,592
May 8	do	3.10	1,242
June 11	do	3.65	1,766
August 14	do	2.70	953
September 16	do	4.52	2,435
October 29	do	2.16	606
December 8	do	2.20	628

Mean daily gage height, in feet, of Broad River near Carlton, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	3.10	7.90	5.80	3.20	4.30	3.00	3.10	2.20	2.20	2.30	2.20
2	3.10	3.00	5.20	4.40	3.10	4.60	2.90	2.70	2.20	2.20	2.30	2.20
3	3.90	3.60	4.00	4.20	3.10	6.00	3.00	3.10	2.20	2.20	2.90	2.20
4	3.70	7.00	3.70	4.40	3.70	4.50	3.40	3.50	2.10	2.20	3.10	2.20
5	3.40	7.80	3.60	4.00	3.50	4.60	2.90	3.70	2.10	2.20	3.00	2.20
6	3.10	5.20	3.70	3.80	3.20	6.10	2.80	3.20	2.10	2.20	3.10	2.30
7	3.00	3.80	3.70	3.70	3.10	8.00	3.30	3.60	2.20	2.20	2.50	2.30
8	2.80	17.60	3.80	4.10	3.10	6.00	2.90	2.50	2.20	2.30	2.40	2.20
9	2.80	11.20	3.60	4.80	3.10	4.80	2.80	2.40	2.20	2.40	2.30	2.20
10	2.80	5.60	4.30	4.10	3.00	4.40	2.70	2.40	2.20	2.30	2.30	2.30
11	2.90	6.50	5.70	3.80	3.00	3.60	2.70	5.30	2.10	2.20	2.30	2.20
12	4.90	10.40	5.80	3.60	2.90	4.80	3.20	3.30	2.10	2.20	2.30	2.20
13	4.70	7.50	4.60	3.60	3.00	3.90	5.50	2.70	2.10	2.20	2.30	2.30
14	3.50	4.40	3.90	6.80	3.20	3.30	4.90	2.70	2.10	2.20	2.30	2.50
15	3.20	4.00	3.70	5.50	3.60	3.20	3.30	4.70	3.20	2.20	2.30	2.30
16	3.10	3.80	3.60	4.00	3.30	3.10	2.90	4.00	4.40	2.20	2.30	2.30
17	2.90	13.10	3.40	3.70	3.10	3.10	2.80	2.90	4.30	2.30	2.30	2.20
18	2.90	12.70	3.40	3.60	3.10	3.00	2.70	7.30	3.20	2.60	2.40	2.20
19	2.80	4.90	3.30	3.50	3.00	3.00	2.70	4.00	2.60	2.40	2.30	2.10
20	2.80	4.10	3.20	3.50	3.00	2.90	2.60	3.60	2.50	2.30	2.30	2.20
21	2.90	3.80	4.10	3.50	3.20	3.10	2.60	2.80	2.50	2.30	2.30	2.50
22	2.80	3.70	5.50	3.40	3.00	2.90	2.50	2.70	2.40	2.20	2.30	2.40
23	2.70	3.50	13.20	3.40	3.00	2.80	2.50	2.60	2.40	2.20	2.20	2.30
24	2.90	3.40	21.00	3.30	2.90	2.80	2.50	2.50	2.40	2.20	2.20	2.20
25	3.10	3.30	10.70	3.30	2.90	2.70	2.40	2.50	2.30	2.20	2.20	2.30
26	3.00	3.30	5.00	3.40	2.80	2.70	2.40	2.50	2.30	2.20	2.20	2.70
27	2.90	3.20	4.40	3.40	2.80	3.10	2.40	2.40	2.30	2.20	2.20	2.50
28	3.10	6.00	4.20	3.30	2.90	5.60	2.30	2.40	2.30	2.10	2.20	2.40
29	3.70	.....	5.40	3.30	2.80	3.60	2.40	2.40	2.20	2.10	2.20	2.30
30	4.30	.....	9.00	3.20	2.90	3.30	2.70	2.30	2.20	2.10	2.20	2.20
31	3.40	.....	9.00	.....	4.00	.....	2.80	2.30	.....	2.20	.....	2.20

Rating table for Broad River near Carlton, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.1	575	3.4	1,490	5.4	3,390	9.5	8,875
2.2	630	3.5	1,570	5.6	3,640	10.0	9,550
2.3	690	3.6	1,655	5.8	3,900	10.5	10,225
2.4	755	3.7	1,740	6.0	4,160	11.0	10,900
2.5	820	3.8	1,825	6.2	4,420	11.5	11,575
2.6	890	3.9	1,910	6.4	4,690	12.0	12,250
2.7	960	4.0	2,000	6.6	4,960	12.5	12,925
2.8	1,030	4.2	2,180	6.8	5,230	13.0	13,600
2.9	1,105	4.4	2,365	7.0	5,500	14.0	14,950
3.0	1,180	4.6	2,555	7.5	6,175	15.0	16,300
3.1	1,255	4.8	2,750	8.0	6,850	16.0	17,650
3.2	1,330	5.0	2,950	8.5	7,225		
3.3	1,410	5.2	3,160	9.0	8,200		

Table well determined up to 5-feet gage height. Above this point the table depends upon measurements made previous to 1903.

Estimated monthly discharge of Broad River near Carlton, Ga., for 1903.

[Drainage area, 762 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,850	960	1,375	1.81	2.09
February	19,810	1,180	4,638	6.09	6.84
March	24,400	1,330	4,110	5.39	6.21
April	5,230	1,330	2,007	2.63	2.93
May	2,000	1,030	1,270	1.67	1.93
June	6,850	960	2,125	2.79	3.11
July	3,510	690	1,150	1.51	1.74
August	5,905	690	1,387	1.82	2.10
September	2,365	575	818	1.07	1.19
October	890	575	651	.85	.98
November	1,255	630	750	.98	1.09
December	960	575	683	.90	1.04
The year	24,400	575	1,747	2.29	30.75

SENECA RIVER NEAR CLEMSON COLLEGE, S. C.

This station was established by M. R. Hall as a regular station on December 8, 1903, at which time a boxed chain gage was installed and the bench marks were established. A vertical gage had been put in July 19, 1903, by F. A. Murray, and records obtained from it for a portion of the time. The station is located at the iron wagon bridge about 3 miles south of Clemson College, S. C., and about 300 feet up the river from the crossing of the Blue Ridge Railroad, which is a branch of the Southern Railway. The bridge is a single span of iron, about 157 feet long, with 40 feet of trestle approach on the right bank and 70 feet on the left bank. At ordinary stages the channel is about 150 feet wide. The right bank is high and will not overflow, but the left bank will overflow for a considerable width at a gage height of about 23 feet. The bed of the river is sandy. The current is moderate. At low stages there is a daily fluctuation of about 1 foot in the gage heights, caused by the operation of water powers above. On this account the gage is read twice each day, and a mean of the two readings is used. The observer is M. L. Sanders.

Discharge measurements are made from the downstream side of the bridge, and the initial point is the center of the tubular iron pier at the right bank downstream. The boxed chain gage is located on the

lower chord on the downstream side. The 24-inch box extends from 20 to 22 feet from the initial point. The chain is 31.82 feet long from the bottom of the weight to the marker. The vertical gage is of 2 by 4 inch timbers in 5-foot sections, fastened to a scantling which is clamped to the iron braces between the cylinders of the right bank pier. Both gages are in good condition, except that mud accumulates at the lower end of the vertical gage.

Bench mark No. 1 is the top of the upstream cylinder of the right bank pier at a point marked "B. M." by chisel cuts. Its elevation is 28.95 feet above gage datum. Bench mark No. 2 is a copper plug set in rock on the right bank under the railroad bridge and about 20 feet to the right of the center pier. Its elevation is 10.27 feet above gage datum. This rock is low and has been uncovered by erosion of the bank. Bench mark No. 3 is a bench cut on the root of a hickory tree at the fork of the roads about 100 feet from the right bank end of the bridge. Its elevation is 30.52 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Seneca River near Clemson College, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 10	F. A. Murray	4.54	1,388
July 28	do	3.53	959
July 29	do	3.56	1,077
August 27	do	3.14	869
September 23	do	2.51	616
October 9	J. M. Giles	3.43	1,050
December 8	W. E. Hall	2.21	539

Mean daily gage height, in feet, of Seneca River near Clemson College, S. C., for 1903.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	2.8	2.40	9	3.1	2.40	17	2.9	2.80	25	2.5	3.10
2	2.8	2.50	10	2.8	2.35	18	3.8	2.45	26	2.6	3.00
3	3.5	2.50	11	2.8	2.70	19	3.1	2.30	27	2.6	2.30
4	4.9	2.70	12	2.7	2.45	20	3.0	2.20	28	2.6	3.10
5	5.7	2.70	13	2.8	2.50	21	3.0	2.30	29	2.5	2.60
6	4.7	2.65	14	2.6	2.80	22	2.8	2.90	30	2.6	2.60
7	3.0	2.50	15	2.8	2.65	23	3.0	2.80	31		2.45
8	3.0	2.40	16	2.8	2.60	24	2.8	2.80			

Rating table for Seneca River near Clemson College, S. C., from November 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.2	550	3.1	860	4.0	1,180	4.9	1,530
2.3	584	3.2	895	4.1	1,218	5.0	1,570
2.4	618	3.3	930	4.2	1,256	5.1	1,610
2.5	652	3.4	965	4.3	1,294	5.2	1,650
2.6	686	3.5	1,000	4.4	1,332	5.3	1,690
2.7	720	3.6	1,036	4.5	1,370	5.4	1,730
2.8	755	3.7	1,072	4.6	1,410	5.5	1,770
2.9	790	3.8	1,108	4.7	1,450	5.6	1,810
3.0	825	3.9	1,144	4.8	1,490	5.7	1,850

Table well determined to 4.50 feet gage height.

Estimated monthly discharge of Seneca River near Clemson College, S. C., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
November	1,850	652	861
December	860	550	685

TUGALOO RIVER NEAR MADISON, S. C.

This station was originally established July 19, 1898, at Cook's ferry and was discontinued December 31, 1901, when the ferry was moved. It was reestablished July 7, 1903, by M. R. Hall. It is located at Holcomb's ferry, 1 mile west of Madison, S. C., and 900 feet below the Southern Railway bridge. This station is about 1½ miles above the point where the old station was located. The gage consists of a vertical timber in three sections. The first section reads from 1 to 16 feet and is attached to a sycamore tree on the left bank about 30 feet, above the ferry landing. The second section reads from 16 to 22 feet and is attached to a sycamore tree on the left bank, about 18 feet above the ferry landing. The third section reads from 21 to 31 feet and is fastened to a locust tree on the left bank at the forks of the road, about 175 feet from the ferry landing. The gage is read once daily by T. A. Spencer, a farmer. Discharge measurements are made from the ferryboat, which is held in place by a cable stretched across the river, a rope running from each end of the boat to a pulley on the

cable. A small boat is also used. The initial point for soundings is the side away from the river of the windlass used for stretching the cable; it is located on the right bank. Distances are measured along the hand line which is used to pull the boat across the river.

The bed of the river is sandy and the current is moderately swift. The channel is about 160 feet wide and is fairly uniform in width and general appearance for some distance above and below, the current being moderately swift and the channel straight for 1,000 feet or more both above and below the station. The banks are both moderately high, but will overflow for about 200 feet on right bank and 250 feet on the left. Both are open and cultivated except a few trees along the edge of the river. These conditions make it possible to obtain fairly good float measurements at time of floods.

Bench mark No. 1 is a nail in a willow tree on the right bank 20 feet below the ferry landing. It is 7 feet above the zero of the gage. Bench mark No. 2 consists of two large nails in the locust tree to which the third section of the gage is attached. They are at an elevation of 22 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock on the north side of the railroad 10½ feet from the north rail and about 400 feet east of the east end of the Southern Railway bridge. Its elevation is 44.27 feet above the zero of the gage. Bench mark No. 4 is the Geological Survey standard plate bench mark on the right bank pier of the Southern Railway bridge. Its elevation is 35.37 feet above the zero of the gage, and 665 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tugaloo River near Madison, S. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 24	J. M. Giles	4.00	1,927
July 7	M. R. Hall	3.69	1,677
July 9	F. A. Murray	3.40	1,535
July 31	do	2.84	1,091
August 28	do	2.18	798
September 24	do	1.94	715
October 9	J. M. Giles	2.23	927

Mean daily gage height, in feet, of Tugaloo River near Madison, S. C., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.80	2.00	1.70	1.80	1.60	17	3.30	4.90	3.90	1.70	1.80	1.70
2	.....	5.40	1.90	1.70	1.90	1.60	18	3.20	3.80	3.50	2.40	2.80	1.70
3	.....	4.60	1.90	1.90	2.80	1.60	19	3.10	2.90	2.30	2.00	2.20	1.50
4	.....	4.20	1.90	1.80	2.20	1.60	20	3.10	2.70	2.10	1.80	1.90	1.70
5	.....	3.40	1.90	1.70	3.00	1.60	21	3.00	3.00	2.00	1.80	1.80	2.50
6	.....	2.90	1.90	1.70	2.50	1.70	22	2.90	2.60	2.00	1.70	1.80	2.00
7	3.70	2.80	1.80	1.80	2.10	1.60	23	2.90	2.50	1.90	1.70	1.80	1.90
8	3.70	2.70	1.80	2.40	1.90	1.60	24	2.80	2.40	1.90	1.70	1.80	1.60
9	3.40	2.50	1.80	2.40	1.90	1.60	25	2.70	2.30	1.90	1.60	1.70	1.00
10	3.60	2.40	1.90	1.90	1.80	1.60	26	2.70	2.30	1.80	1.60	1.70	2.00
11	3.90	3.00	1.80	1.80	1.80	1.60	27	2.70	2.20	1.90	1.60	1.70	1.90
12	4.40	2.80	1.70	1.80	1.80	1.60	28	2.60	2.10	1.90	1.60	1.60	1.80
13	4.50	2.70	1.70	1.70	1.90	1.80	29	3.10	2.10	1.80	1.60	1.60	1.80
14	4.10	2.60	1.70	1.70	1.90	2.00	30	2.70	2.10	1.70	1.60	1.60	1.80
15	3.60	2.70	4.10	1.60	1.80	1.80	31	2.90	2.00	.....	1.60	.....	1.80
16	3.20	4.30	5.60	1.60	1.90	1.80							

Rating table for Tugaloo River near Madison, S. C., from July 7 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	510	2.5	980	3.5	1,560	4.5	2,320
1.6	552	2.6	1,032	3.6	1,630	4.6	2,400
1.7	596	2.7	1,086	3.7	1,700	4.7	2,480
1.8	640	2.8	1,140	3.8	1,775	4.8	2,560
1.9	686	2.9	1,195	3.9	1,850	4.9	2,640
2.0	732	3.0	1,250	4.0	1,925	5.0	2,720
2.1	780	3.1	1,310	4.1	2,000	5.4	3,040
2.2	828	3.2	1,370	4.2	2,080	5.6	3,200
2.3	878	3.3	1,430	4.3	2,160		
2.4	928	3.4	1,495	4.4	2,240		

Table well determined between gage heights 1.8 and 4 feet.

Estimated monthly discharge of Tugaloo River near Madison, S. C., for 1903.

[Drainage area, 598 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July 7–31	2,320	1,032	1,441	2.43	2.26
August	3,040	732	1,283	2.16	2.49
September	3,200	596	874	1.47	1.64
October	928	552	634	1.07	1.23
November	1,250	552	720	1.21	1.35
December	980	510	623	1.05	1.21

MISCELLANEOUS MEASUREMENTS IN SAVANNAH RIVER DRAINAGE BASIN.

Eighteenmile Creek.—This stream was measured 3½ miles southeast of Calhoun, S. C. The bench mark is the top of downstream end of cap, 35 feet from right-bank end of bridge.

Discharge measurements of Eighteenmile Creek 3½ miles southeast of Calhoun, S. C.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
July 11	5.43	392
July 30	8.12	48
September 23	8.08	51

Twelvemile Creek.—This stream was measured 1 mile northwest of Calhoun, S. C. The bench mark is the top of downstream corner of left-bank pier.

Discharge measurements of Twelvemile Creek 1 mile northwest of Calhoun, S. C.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
July 11	4.45	374
July 30	5.13	225
September 23	5.91	192

Chauga Creek.—This stream was measured at Bryan's bridge, 2 miles east of Fort Madison, S. C. The bench mark is a spike in a sycamore sapling, 100 feet above bridge on left bank.

Discharge measurements of Chauga Creek 1 mile east of Fort Madison, S. C.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
August 29	3.00	168
September 24	3.25	133

Brier Creek.—At Ray's bridge, 3½ miles northeast of Waynesboro, Ga., this stream was discharging 246 second-feet on October 12, 1903, when the water surface was 9.66 feet below end of plank, 43 feet from right-bank end of bridge, downstream side.

McIntosh Creek.—One mile south of Waynesboro, Ga., this stream had a discharge of 3.7 second-feet on October 12, 1903.

South Broad River.—At Carlton, Ga., this stream had a discharge of 219 second-feet on October 12, 1903.

Tallulah River.—At Tallulah Falls, Ga., this stream had a discharge of 698 second-feet on June 23, 1903; gage height (old gage), 1.96 feet.

OGEECHEE RIVER DRAINAGE BASIN.

Ogeechee River is formed by the junction of Williamsons Swamp Creek and Rocky Comfort Creek in Jefferson County, Ga., and drains a small basin in southeastern Georgia lying between the Savannah and Altamaha basins. Ogeechee River runs in a southeasterly direction and empties into the Atlantic Ocean. Its main tributary is Cannoochee River, which rises in Emanuel County, Ga., and flows southeast, joining the Ogeechee about 20 miles from the Atlantic Ocean. The streams in this basin run through a country that is mostly low. The current is generally good, but the fall available for power is probably small. The bank on one side or the other of the stream is generally low and swampy. During 1903 the United States Geological Survey maintained the following stations in this basin under the direction of M. R. Hall: Williamsons Swamp Creek at Davisboro, Ga.; Ogeechee River, near Millen, Ga.; and Cannoochee River, near Groveland, Ga.

CANNOOCHEE RIVER NEAR GROVELAND, GA.

This station was established June 12, 1903, by F. A. Murray. It is located at Moody's bridge, 3 miles south of Groveland, Bryan County, Ga. The vertical gage is in three sections. The first section is a 1⅛ by 4 inch pine board, reading from 1 to 5 feet, with brass figures for footmarks. The second section is a pine rod ⅞ inch by 4 inch and 12 feet long, marked with brass tacks. These sections are nailed to the right side of the upstream post of the fourth bent from the right bank. From 17 to 20 feet the post is graduated to feet and half feet with nails and brass figures. These sections are opposite a point 61 feet from the initial point for soundings. A third section of the gage reading from 5 to 10 feet is fastened to a gum tree on the left bank 25 feet above the bridge. This gage faces the bridge and is used for the stages which it covers. The observer is J. M. Edwards, who reads the gage once each day. Discharge measurements are made from the downstream side of the 9-span wooden highway bridge. The initial point for soundings is the outer edge of the post which supports the end of the hand rail of the downstream side of the bridge on the left bank. The channel is straight for about 300 feet above and for about 400 feet below the station. The current is swift in the main channel and sluggish near the banks. Both banks are of clay

and sand and overflow at from 15 to 16 feet gage height. The bed of the stream is of silt and is shifting. There is but one channel at all stages up to the height at which the river overflows its banks.

Bench mark No. 1 is the top of the bridge floor at the fourth bent from the left end of the bridge on the upstream side opposite a point 61 feet from the initial point for soundings. The point is marked by a cross and the letters B. M. cut in the floor. It is at an elevation of 20 feet above the zero of the gage. Bench mark No. 2 is a spike in a pine tree which stands near the upstream side of the road 15 feet from the left end of the bridge and 9 feet upstream from the line of the edge of the bridge. It is at an elevation of 20.12 feet above the zero of the gage. Bench mark No. 3 consists of two large wire nails driven into the tree to which the third section of the gage is fastened at a gage height of 5.30 feet. Two more nails are also driven at the 8-foot mark.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Cannoochee River near Groveland, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 12	F. A. Murray	12.90	3,467
June 23	do	5.20	734
July 17	do	9.97	2,224
Do	do	9.92	2,562
August 21	do	15.11	4,125
October 9	do	4.45	462
November 18	do	5.05	734
December 29	do	6.20	1,014

Mean daily gage height, in feet, of Cannoochee River near Groveland, Ga., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		9.80	2.60	5.50	5.70	3.80	4.40
2		8.00	2.60	5.10	5.40	3.90	4.30
3		6.90	2.60	5.00	5.80	5.40	4.30
4		6.40	2.70	4.50	5.10	6.20	4.20
5		6.10	3.20	4.80	4.80	6.70	4.10
6		6.30	4.30	4.90	4.70	6.90	4.10
7		5.90	6.00	4.60	4.60	6.60	3.90
8		5.40	6.70	4.20	4.60	6.20	3.80
9		5.90	6.70	4.00	4.50	5.90	3.80
10		6.80	5.50	3.80	4.30	5.60	4.50
11		8.70	4.90	3.70	4.20	5.20	4.60

Mean daily gage height, in feet, of Cannoochee River, etc.—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12	.....	10.60	4.50	3.60	4.00	5.00	4.50
13	.....	9.70	4.90	3.70	3.90	4.80	4.30
14	.....	9.50	7.20	3.80	3.80	4.70	4.30
15	.....	9.20	8.10	7.70	3.80	4.70	4.30
16	.....	9.50	10.10	13.80	3.70	4.50	4.30
17	.....	10.00	11.10	17.80	3.70	4.50	4.10
18	.....	9.50	17.20	18.00	5.70	5.00	3.80
19	.....	8.90	16.70	17.30	7.90	5.00	3.90
20	.....	8.20	16.00	16.50	8.80	4.60	3.80
21	.....	5.50	15.20	15.70	9.40	4.50	3.90
22	.....	5.20	15.00	14.70	8.90	4.40	4.00
23	5.20	4.90	16.00	13.20	7.90	4.20	4.10
24	5.70	3.70	15.80	11.30	6.60	4.00	4.00
25	5.60	3.50	15.10	9.60	6.00	4.00	4.00
26	5.70	3.30	13.80	8.20	5.40	4.10	4.40
27	5.20	3.30	12.00	7.30	4.70	4.50	5.20
28	6.50	3.20	10.40	6.60	4.40	4.60	5.50
29	8.10	3.00	8.50	6.30	4.20	4.50	6.20
30	9.00	2.90	7.00	6.10	4.00	4.30	6.90
31	.....	2.70	6.00	.....	3.90	.....	7.70

Rating table for Cannoochee River near Groveland, Ga., from June 23 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.6	142	3.9	316	6.4	1,150	9.0	2,060
2.7	151	4.0	338	6.6	1,220	9.5	2,235
2.8	160	4.2	389	6.8	1,290	10.0	2,410
2.9	170	4.4	451	7.0	1,360	10.5	2,585
3.0	180	4.6	520	7.2	1,430	11.0	2,760
3.1	191	4.8	590	7.4	1,500	11.5	2,935
3.2	203	5.0	660	7.6	1,570	12.0	3,110
3.3	216	5.2	730	7.8	1,640	12.5	3,285
3.4	230	5.4	800	8.0	1,710	13.0	3,460
3.5	245	5.6	870	8.2	1,780	13.5	3,635
3.6	261	5.8	940	8.4	1,850	14.0	3,810
3.7	278	6.0	1,010	8.6	1,920		
3.8	296	6.2	1,080	8.8	1,990		

Table not well determined below 4.45 feet gage height and above 15 feet gage height. Above 4.50 feet gage height the curve becomes a tangent, with difference of 35 per tenth.

Estimated monthly discharge of Cannoochee River near Groveland, Ga., for 1

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 23–30	2,060	730	1,34[illegible]
July	2,620	151	1,3[illegible]
August	4,930	142	2,10[illegible]
September	5,210	261	1,85[illegible]
October	2,200	278	7[illegible]
November	1,325	296	64[illegible]
December	1,605	296	499

OGEECHEE RIVER NEAR MILLEN, GA.

This station was established June 20, 1903, by F. A. Murray. It is located at Daniel's toll bridge, 1 mile west of Millen, Ga. The gage is a vertical seven-eighths inch by 4-inch pine rod, graduated to feet and tenths and numbered with tacks from zero to 10 feet and with brass figures from 10 to 12 feet. The rod is nailed to the upstream post of the third bent from the toll house. The gage was read once daily during 1903 by T. J. Lane, the tollkeeper. Discharge measurements were made from the upstream side of the wooden highway bridge to which the gage is attached. The bridge is at an angle of about 45° to the current. The initial point for soundings is the end of the hand rail at the tollhouse on the left bank, upstream, side of the bridge. The channel is straight for about 300 feet above and about 500 feet below the bridge. The current is swift in the main channel and sluggish near the banks. The right bank is low and overflows. There is a trestle approach for about 300 feet over low, swampy land on this side of the river. The left bank is lower than the right bank, the swamp extending back from the river about one-fourth of a mile. The bed of the stream is sandy and shifting. There is but one channel at ordinary stages, but several channels at high water.

Bench mark No. 1 is the top of the upstream end of the cap of the first bent from the tollhouse. It is 12 feet above the zero of the gage. Bench mark No. 2 consists of a notch and nails in the corner of the tollhouse next the river. They are 18 feet above the zero of the gage. Bench mark No. 3 is the center of the head of a large cut nail driven horizontally in a small hickory tree on the left bank about 50 feet below the bridge. Its elevation is 6.32 feet above the zero of the gage. Bench mark No. 4 is a cut on the sloping base of a hickory tree at the edge of the water on the left bank, about 70 feet above the bridge. A large nail is driven vertically in the cut. Its elevation is 5.48 feet above the zero of the gage. The station was discontinued

December 31, 1903, on account of poor conditions for accurate measurement of the flow.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Ogeechee River near Millen, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 20	F. A. Murray	5.06	1,548
July 30	M. R. Hall	2.35	515
October 10	F. A. Murray	2.08	470
Do	do	2.09	519
November 20	do	4.00	889

Mean daily gage height, in feet, of Ogeechee River near Millen, Ga., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		6.00	2.30	2.40	2.50	2.60	4.00
2		5.70	2.40	2.30	2.40	2.60	3.90
3		5.50	2.70	2.30	2.30	2.70	3.80
4		5.30	3.00	2.30	2.20	2.90	3.80
5		5.30	3.10	2.20	2.10	3.00	3.80
6		5.30	3.40	2.20	2.00	3.20	3.70
7		5.20	3.80	2.10	2.00	3.50	3.70
8		5.00	4.20	2.00	2.00	3.80	3.70
9		5.40	4.10	1.90	2.00	4.00	3.70
10		5.80	3.90	1.90	2.10	4.20	3.70
11	6.50	5.50	3.60	1.80	2.10	4.50	3.70
12	7.10	5.70	3.30	1.70	2.10	4.60	3.80
13	6.90	6.20	3.10	1.50	2.10	4.70	3.80
14	6.70	6.40	3.00	1.60	2.10	4.80	3.80
15	6.60	6.40	3.30	1.90	2.20	4.70	3.90
16	6.50	6.30	3.50	4.10	2.20	4.50	3.90
17	6.20	6.40	3.90	4.90	2.20	4.30	4.00
18	5.90	6.30	4.00	5.50	2.30	4.10	4.00
19	5.50	6.00	4.20	5.60	2.80	4.00	4.00
20	5.20	5.70	4.80	5.40	3.40	4.00	4.00
21	5.00	5.40	5.70	5.10	3.80	4.00	4.00
22	4.80	5.00	6.00	4.90	4.00	4.00	4.10
23	4.80	4.60	5.90	4.80	4.00	4.00	4.20
24	4.90	4.00	5.70	4.70	4.00	4.00	4.30
25	4.80	3.60	5.50	4.50	4.00	4.00	4.40
26	4.60	3.30	5.30	4.10	4.00	4.00	4.50
27	4.70	3.00	5.10	3.50	3.80	4.00	4.70
28	5.10	2.80	4.80	3.00	3.40	4.00	4.90
29	5.50	2.60	4.00	2.70	3.00	4.10	5.10
30	5.80	2.50	3.30	2.60	2.80	4.10	5.30
31		2.30	2.60		2.60		5.50

Rating table for Ogeechee River near Millen, Ga., from June 11 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	418	2.8	595	4.1	933	5.4	1,860
1.6	428	2.9	611	4.2	980	5.5	1,960
1.7	440	3.0	628	4.3	1,030	5.6	2,065
1.8	452	3.1	646	4.4	1,085	5.7	2,170
1.9	465	3.2	665	4.5	1,145	5.8	2,275
2.0	478	3.3	685	4.6	1,210	6.0	2,490
2.1	492	3.4	707	4.7	1,275	6.2	2,710
2.2	506	3.5	731	4.8	1,345	6.4	2,930
2.3	520	3.6	757	4.9	1,420	6.6	3,150
2.4	534	3.7	785	5.0	1,500	6.8	3,370
2.5	549	3.8	816	5.1	1,585	7.0	3,590
2.6	564	3.9	850	5.2	1,675		
2.7	579	4.0	889	5.3	1,765		

Table not well determined.

Estimated monthly discharge of Ogeechee River near Millen, Ga., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 11-30	3,700	1,210	2,183
July	2,930	520	1,771
August	2,490	520	1,077
September	2,065	418	855
October	889	478	609
November	1,345	564	905
December	1,960	785	989

WILLIAMSONS SWAMP CREEK AT DAVISBORO, GA.

This station was established June 19, 1903, by F. A. Murray. It is located at the Davisboro highway bridge, about 200 yards south of the Central of Georgia Railroad station, which is in the middle of the town. The gage is a vertical 1 by 3 inch wooden rod 10 feet long, graduated to feet and tenths with notches and numbered with brass figures. The rod is nailed to the left side of the upstream post of the bent which supports the bridge, at a point 302 feet from the initial point for soundings. The gage is read once each day by A. Baker,

a hotel proprietor. Discharge measurements are made from the upstream side of the wooden highway bridge, which is supported by wooden bents about 18 feet apart. The initial point for soundings is the outer edge of the post which supports the end of the hand rail on the left bank upstream side of the bridge. The channel is straight for about 200 feet above and below the station. The right bank is low and overflows at a gage reading of 4 to 4½ feet. The left bank will overflow at a gage height of 3 feet. The bed of the stream is sandy and is slightly shifting. There is but one channel at all stages. The current is somewhat obstructed by the bents which support the bridge at low water and by trees and brush on the banks at high water.

Bench mark No. 1 is the top of the bridge floor at the bent 302 feet from the initial point for soundings on the upstream side of the bridge. The point is marked with a cross and the letters "B. M." cut into the top of the bridge floor plank. Its elevation is 11 feet above the zero of the gage, which is attached to the same bent. Bench mark No. 2 is the center of a large wire nail driven horizontally in an ash tree which stands in the creek near the right bank about 40 feet below the bridge. The nail is on the side of the tree toward the bridge and is at an elevation of 5.50 feet above the zero of the gage. Bench mark No. 3 is the center of a large wire nail driven horizontally in a small cypress tree on the right bank about 45 feet below the bridge. The nail is on the side of the tree toward the bridge and is at an elevation of 5.50 feet above the zero of the gage. The nails for both bench marks are driven within about one-half inch of the wood, from which the bark has been removed.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Williamson's Swamp Creek at Davisboro, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 19	F. A. Murray	2.41	83
July 18	do	2.58	100
July 29	M. R. Hall	1.64	46
Do	do	1.64	45
October 13	F. A. Murray	1.72	47
Do	do	1.64	41
November 21	do	2.58	94
December 28	do	2.69	97

Mean daily gage height, in feet, of Williamson's Swamp Creek at Davisboro, Ga., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.50	2.10	1.80	1.70	2.10	2.40
2	.....	2.30	4.00	1.90	1.80	2.20	2.50
3	.....	3.30	2.40	1.70	1.80	2.10	2.70
4	.....	3.70	3.50	1.70	1.70	2.40	2.80
5	.....	2.30	3.00	1.70	1.50	4.40	2.40
6	.....	2.30	2.40	1.80	1.60	3.20	2.40
7	.....	5.80	2.10	1.70	1.60	2.90	2.20
8	.....	5.00	2.00	1.70	2.00	2.50	2.30
9	.....	3.50	1.80	1.70	2.00	2.40	2.40
10	.....	3.90	1.90	1.70	2.00	2.40	2.50
11	.....	3.20	2.10	1.70	1.90	2.50	2.60
12	.....	4.30	2.30	1.70	1.80	2.40	2.50
13	.....	3.60	2.30	1.80	1.70	2.60	2.50
14	.....	5.10	2.20	1.90	1.70	2.60	2.40
15	.....	4.70	2.10	3.00	1.70	2.50	2.50
16	.....	3.40	2.10	4.00	1.80	2.50	2.50
17	.....	2.80	2.30	3.00	2.90	2.50	2.50
18	.....	2.60	2.10	2.80	4.00	2.50	2.50
19	2.40	2.50	3.00	2.50	2.40	2.70	2.40
20	2.50	2.50	3.80	1.90	2.10	2.50	2.60
21	2.50	2.30	3.60	1.80	2.20	2.60	3.00
22	2.60	2.10	3.20	2.00	2.20	2.60	2.80
23	2.40	2.10	2.10	1.90	2.10	2.50	2.50
24	2.30	2.10	2.00	2.00	2.00	2.50	2.50
25	2.20	2.30	2.10	1.90	2.10	2.40	2.80
26	2.20	2.30	1.90	1.90	2.00	2.40	3.30
27	2.20	1.90	1.80	2.00	2.00	2.50	3.80
28	4.40	1.80	1.80	1.90	2.00	2.50	2.60
29	4.00	1.70	1.70	1.80	2.10	2.50	2.70
30	2.90	1.80	1.70	1.80	2.10	2.40	2.70
31	.....	1.80	1.80	.....	2.20	.....	2.70

Rating table for Williamson's Swamp Creek at Davisboro, Ga., from June 19 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	40	2.7	101	3.9	191	5.1	297
1.6	44	2.8	108	4.0	199	5.2	306
1.7	48	2.9	115	4.1	207	5.3	315
1.8	52	3.0	122	4.2	216	5.4	324
1.9	57	3.1	129	4.3	225	5.5	334
2.0	62	3.2	136	4.4	234	5.6	344
2.1	67	3.3	143	4.5	243	5.7	354
2.2	72	3.4	151	4.6	252	5.8	364
2.3	77	3.5	159	4.7	261	6.0	384
2.4	83	3.6	167	4.8	270		
2.5	89	3.7	175	4.9	279		
2.6	95	3.8	183	5.0	288		

Table not well determined above 2.70 feet gage height.

Estimated monthly discharge of Williams's Swamp Creek at Davisboro, Ga., in 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 19–30	234	72	107
July	364	48	127
August	199	48	85
September	199	48	66
October	199	40	65
November	234	67	94
December	183	72	97

MISCELLANEOUS MEASUREMENTS IN OGEECHEE RIVER DRAINAGE BASIN.

Cannoochee River.—At Moore's bridge, 2½ miles northwest of Groveland, Ga., this stream was discharging 1,958 second-feet on June 9, 1903, when the water surface was 6.87 feet below the top of first bent from right bank, upstream side of bridge.

Buckhead Creek.—This stream was measured at Daniel's bridge, 1 mile northwest of Millen, Ga. The bench mark is the top of first bent from a large cypress stump near the right bank, downstream side of bridge.

Discharge measurements of Buckhead Creek at Daniel's bridge, 1 mile northwest of Millen, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
June 10	4.68	617
June 11	3.33	1,163
June 20	6.71	251
July 18	5.02	500
October 10	9.34	107

Cannoochee River.—At bridge (Hendrix) 1½ miles from Claxton, Ga., this stream was discharging 469 second-feet on June 22, 1903, when the water surface was 13.40 feet below bridge floor at 50 feet from outer edge of post at end of hand rail, right bank upstream side.

Cedar Creek.—At 1¾ miles northwest of Claxton, Ga., this stream was discharging 11 second-feet on June 22, 1903, when the water surface was 10.13 feet below bridge floor at midstream.

Bull Creek.—At new bridge 2 miles southeast of Claxton, Ga., this stream was discharging 18 second-feet on June 22, 1903, when the water surface was 5.40 feet below top of upstream end of cap of first bent from right bank.

Lotts Creek.—This stream was measured at a foot log 100 yards above its mouth, about 2 miles northwest of Groveland, Ga. The bench mark is a large spike in a 9 by 9 post near right bank.

Discharge measurements of Lotts Creek about 2 miles northwest of Groveland, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
June 23	8.00	253
October 9	9.47	119
Do	9.47	112

Williamson's Swamp Creek (*west prong*).—At Buffalo Ford, near Sandersville, Ga., this stream was discharging 16 second-feet on July 2, 1903, when the water was at ordinary stage.

Williamson's Swamp Creek (*north prong*).—At Jones's bridge, near Sandersville, Ga., this stream was discharging 19 second-feet on July 2, 1903, when the water was at ordinary stage.

Williamson's Swamp Creek.—At Jordan's Mill bridge, near Sandersville, Ga., this stream was discharging 95 second-feet on July 2, 1903, when the water was at ordinary stage.

Ogeechee River.—At Harrison's bridge, 2 miles west of Agricola, Ga., this stream was discharging 24 second-feet on October 14, 1903, when the water surface was 19.56 feet below the top of bent at right end of bridge downstream side.

Little Ogeechee River.—Near Agricola, Ga., this stream was discharging 4.2 second-feet on October 14, 1903, when the water surface was 13.83 feet below top of floor at hand-rail brace.

Ogeechee River.—At wagon bridge 5 miles northeast of Davisboro, Ga., this stream was discharging 194 second-feet on November 20, 1903, when the water surface was 12.20 below top of second bent from left bank.

ALTAMAHA RIVER DRAINAGE BASIN.

Altamaha River is formed by the junction of Oconee and the Ocmulgee rivers, which unite at the southern boundary of Montgomery County, Ga. Ohoopee River is also a tributary and enters it, from the north side, about 50 miles below the junction of the Oconee and Ocmulgee. The Altamaha River drainage is entirely within the State of Georgia. It rises in the north-central part and flows in a southeasterly direction, emptying into the Atlantic Ocean near Darien. Below the junction of the Oconee and Ocmulgee and for a long dis-

tance above, on both rivers, there is no great amount of fall. Steamboat navigation is carried on from Darien to Macon on the Ocmulgee, and to Dublin, and at times to Milledgeville, on the Oconee.

Ohoopee River rises in Washington County and flows in a southeasterly direction to the Altamaha. It flows from the low hills of southeastern Georgia into the flat pine lands. Though it has not so much fall as the more northern streams, it has considerable fall that can be developed into power.

Oconee River rises on the southern slope of the Chattahoochee Ridge, in Hall County, and joins the Middle Oconee on the southwest boundary of Clarke County. From there it flows in a southeasterly direction to the Altamaha. Apalachee River is a large tributary which rises in Gwinnett and Walton counties and enters the Oconee near the southeastern corner of Morgan County. Little River enters the main stream, at the corner of Putnam, Hancock, and Baldwin counties, about 15 miles above Milledgeville, Ga. These tributaries have much fall, and a small part of it is developed. The Oconee has a fall of 250 feet in 45 miles. It has some very large water powers available from its source down to Milledgeville, where it crosses the fall line.

Ocmulgee River, the most westerly of the main tributaries, rises in the north-central part of Georgia on the southern slope of the Chattahoochee Ridge in Fulton, Dekalb, and Gwinnett counties. It is formed by the junction of Yellow and South rivers just south of the southern corner of Newton County. Yellow River rises in Gwinnett County and flows in a southerly direction into the Ocmulgee. South River rises in Fulton and Dekalb counties and flows in a southeasterly direction. Alcovy River joins the Ocmulgee about 5 miles below the junction of the South and Yellow rivers. Towaliga River enters the Ocmulgee at about the southwest corner of Jasper County.

All these tributaries rise in and flow through a very hilly country and have a great deal of fall. Ocmulgee River has a fall of over 210 feet in 35 miles. The last fall of much size is only a few miles above Macon, Ga.

During 1903 the United States Geological Survey maintained the following stations in this basin, under the direction of M. R. Hall: Ohoopee River near Reidsville, Ga.; Oconee River near Dublin, Ga.; Oconee River at Milledgeville, Ga.; Oconee River near Greensboro, Ga.; Apalachee River near Buckhead, Ga.; Ocmulgee River at Macon, Ga.; Ocmulgee River near Flovilla, Ga.; Alcovy River near Covington, Ga.; South River near Lithonia, Ga.

OHOOPEE RIVER NEAR REIDSVILLE, GA.

This station was established June 13, 1903, by F. A. Murray. It is located at the wooden highway bridge, commonly known as Sheppards bridge, 4½ miles west of Reidsville. The gage is on the down-

stream side of the middle post which supports the bridge protector. The section from zero to 8 feet is roughly graduated with white paint on a 1 by 3 inch pine strip which is nailed to the post. From 8 to 10 feet the post is graduated to feet and tenths with white paint, and from 10 to 13 feet to feet and half feet. From 13 to 20 feet it is graduated to feet with nails and numbered with brass figures. On November 19, 1903, a new 1 by 4 inch section 5 feet long, reading from 3 to 8 feet, was spiked to a pine plank which is securely nailed to a cypress tree on the left bank of the river about 120 feet above the bridge. This section can be extended to extreme high water on the same tree, and probably also to low water.

Bench mark No. 1 is the top of the cap of the fifth bent from the left end of the bridge on the upstream side, opposite a point 106 feet from the initial point for soundings. It is at an elevation of 20 feet above the zero of the gage. Bench march No. 2 consists of two nails driven horizontally in the downstream side of a cypress tree on the left bank about 120 feet above the bridge. This bench mark is 8 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction M. R. Hall, district hydrographer.

Discharge measurements of Ohoopee River near Reidsville, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 13	F. A. Murray	12.47	5,762
June 24	do	6.41	1,692
July 16	do	10.34	3,667
Do	do	10.46	3,756
August 22	do	14.00	6,441
October 8	do	2.84	476
Do	do	2.85	462
November 19	do	4.96	1,131
December 30	do	6.69	1,836

Mean daily gage height, in feet, of Ohoopee River near Reidsville, Ga., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.60	2.00	4.60	3.30	2.40	3.90
2		8.30	2.10	4.30	3.10	2.40	3.70
3		8.40	2.70	4.50	2.90	2.40	3.60
4		7.70	3.40	4.00	2.80	3.10	3.40
5		6.80	3.70	3.50	2.60	3.90	3.30
6		6.00	4.00	3.40	2.50	4.60	3.20
7		5.50	3.90	3.20	2.70	5.20	3.10
8		5.50	3.30	3.50	2.90	5.30	3.10

Mean daily gage height, in feet, of Ohoopee River, etc.—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9		5.70	3.10	3.50	2.90	5.70	3.30
10		6.00	3.60	3.20	2.70	5.00	3.40
11		7.30	4.20	2.30	2.60	5.10	3.60
12		6.60	5.30	2.40	2.30	4.80	3.60
13		6.50	4.60	(a)	2.20	4.70	3.50
14		7.40	3.80	(a)	2.10	4.10	3.50
15		9.70	3.80	(a)	2.00	5.30	3.40
16		10.60	8.30	(a)	2.00	5.40	3.30
17		9.50	10.30	(a)	2.20	5.60	3.30
18		9.60	9.90	(a)	5.00	5.40	3.10
19		10.30	10.30	(a)	6.70	5.00	3.00
20		9.50	14.00	10.80	6.90	4.70	2.90
21		8.10	13.80	10.50	6.50	4.50	3.00
22		6.70	14.00	8.40	5.70	4.40	3.30
23		5.70	13.20	7.20	5.00	4.30	3.30
24	6.50	4.70	12.00	6.50	4.60	4.10	3.20
25	6.70	4.00	11.40	6.40	3.70	4.00	3.30
26	6.90	4.00	10.50	6.30	3.20	4.10	3.70
27	7.70	3.70	9.00	4.30	2.90	4.80	5.30
28	8.70	3.20	7.70	4.10	2.70	4.40	6.30
29	10.20	2.50	6.70	3.90	2.50	4.20	6.60
30	9.30	2.50	5.50	3.60	2.30	4.10	6.70
31		2.20	4.80		2.20		6.30

[a] Gage out.

Rating table for Ohoopee River near Reidsville, Ga., from June 23 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	280	3.3	595	5.2	1,220	7.8	2,325
2.1	296	3.4	625	5.4	1,295	8.0	2,415
2.2	314	3.5	655	5.6	1,375	8.5	2,665
2.3	326	3.6	685	5.8	1,455	9.0	2,915
2.4	350	3.7	715	6.0	1,535	9.5	3,175
2.5	375	3.8	745	6.2	1,615	10.0	3,465
2.6	400	3.9	775	6.4	1,695	10.5	3,775
2.7	426	4.0	805	6.6	1,785	11.0	4,130
2.8	453	4.2	870	6.8	1,875	12.0	4,935
2.9	480	4.4	940	7.0	1,695	13.0	5,860
3.0	508	4.6	1,010	7.2	2,055	14.0	6,860
3.1	536	4.8	1,080	7.4	2,145		
3.2	565	5.0	1,150	7.6	2,235		

Table well determined between 2.85 and 10.50 gage height; upper and lower parts somewhat uncertain.

Estimated monthly discharge of Ohoopee River near Reidsville, Ga., in 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
June 24–30	3,585	1,740	2,455
July	3,840	314	1,872
August	6,860	280	2,344
September 1–12 and 20–30 [a]			1,252
October	1,920	280	654
November	1,415	350	966
December	1,830	480	775

[a] Missing dates; gage out.

OCONEE RIVER AT DUBLIN, GA.

Oconee River rises in the northern part of Georgia, near Gainesville, on the southern slope of the Chattahoochee Ridge, which separates the headwaters of this stream from the tributaries of Chattahoochee River. It flows in a southeasterly direction and joins the Ocmulgee at the southern border of Montgomery County to form the Altamaha. The drainage area is for the most part hilly and is made up of cultivated ground broken by extensive tracts of forest.

A station was established by the United States Weather Bureau in 1894 at Dublin, Ga., about 60 miles above the junction of the Oconee with the Ocmulgee. Records were kept, with the exception of the summer months of 1896, until April 30, 1897, when the station was discontinued. In 1898 discharge measurements were commenced by the Geological Survey, and on February 11 an observer was employed to read the gage. On October 15, 1898, the Weather Bureau again adopted the station and has maintained the gage and furnished gage heights to the Geological Survey continuously since that time. The present observer is Roger D. Flynt, who reads the gage once daily.

The gage is a heavy timber bolted to the downstream side of the center pier of the Wrightsville and Tennille Railroad bridge in the eastern part of the city of Dublin. The bridge is a drawbridge, and the pier to which the gage is attached is the circular center pier of the turn span. The gage is graduated to feet and tenths, and the markings face toward the right bank. A secondary gage is attached to a cypress tree on right bank about 200 feet above the railroad bridge. Measurements are made from the iron highway bridge, which is 500 feet upstream from the gage. This bridge is also a drawbridge, and consists of the turn span between two other spans of 75 feet each. The total length of bridge proper is 320 feet. On the left bank, which is low, there is 1,100 feet of iron frame trestle approach. There is also a short trestle on the right bank, which is high. The ordinary

width of the river is about 235 feet. At a gage height of about 20 feet the left bank begins to overflow, and it is practically covered to end of the approach at 25 feet. This ground is thickly covered with a brushy growth, which will no doubt cause the velocity of the water overflowing it to be small. The right bank does not overflow. The bed of the stream is of loose rock, sand, and gravel. The channel is straight and the current is swift and fairly uniform, except where it is broken by the three bridge piers. The initial point for soundings is the end of the bridge at the right bank, on the upstream side.

Bench mark No. 1 is the top of the upstream end of the crossbeam on top of the first tubular pier and is 41.30 feet above the zero of the gage. Bench mark No. 2 is a point on the fifth step from the bottom at the south entrance of the court-house, 6 inches from the east end of the step. Its elevation is 82.51 feet above the zero of the gage. Bench mark No. 3 is the top of the granite water table 2½ feet west of the southeast corner of the court-house. Its elevation is 80.97 feet above the zero of the gage. Bench mark No. 4 consists of three large nails driven into the tree to which the secondary gage is fastened at a point 3 feet above the zero of the gage.

The observations at this station have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Oconee River at Dublin, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 3	J. M. Giles	15.40	20,165
April 4	do	14.95	19,802
June 6	F. A. Murray	8.81	9,804
Do	do	8.51	9,432
June 15	do	4.47	5,017
July 15	do	5.95	6,579
August 24	do	4.61	4,475
October 6	do	.12	1,713
November 14	M. R. Hall	1.15	2,472

Mean daily gage height, in feet, of Oconee River at Dublin, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	4.30	7.90	15.10	3.40	3.30	4.20	0.60	0.40	0.50	0.30	0.80
2	.90	3.80	9.00	14.90	3.10	2.80	3.20	.90	.40	.40	.30	.80
3	2.50	3.40	10.00	15.50	3.00	4.50	2.50	1.00	.00	.30	.60	.60
4	3.50	3.40	12.00	15.00	3.20	6.00	2.20	2.10	−.10	.10	.80	.70
5	4.00	4.00	13.50	14.10	4.80	7.50	2.30	4.20	−.20	.00	1.90	.80
6	5.00	5.80	13.40	12.90	6.00	8.40	1.80	4.60	−.10	−.10	3.80	.70
7	4.50	6.60	12.40	10.90	5.50	9.30	2.80	3.30	−.20	.10	3.00	.80

Mean daily gage height, in feet, of Oconee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	4.00	7.80	11.80	8.90	4.30	10.50	4.80	2.00	−0.20	0.30	3.00	0.90
9	3.20	8.80	11.90	8.20	4.10	11.70	5.90	1.50	− .20	.60	2.20	.90
10	2.60	11.00	10.80	8.80	4.50	13.00	6.80	.90	− .20	.60	1.80	1.00
11	2.80	21.00	9.50	9.20	4.40	13.10	5.20	1.00	.10	.40	1.10	1.40
12	2.80	24.00	8.80	10.00	3.90	11.20	3.20	1.00	− .10	.20	1.00	2.00
13	3.60	23.40	8.60	10.50	3.50	8.50	3.20	1.20	.00	.10	1.10	1.80
14	4.00	22.70	8.50	10.10	3.30	6.30	4.00	1.00	.10	.10	1.10	1.80
15	4.40	21.50	8.40	9.50	5.30	4.70	5.80	1.20	.50	.00	1.10	1.10
16	3.90	20.00	8.60	9.00	8.50	3.60	6.70	2.60	2.20	.00	1.00	1.30
17	3.20	18.40	8.40	8.50	9.80	3.20	7.30	3.80	6.50	.50	1.10	1.30
18	3.20	16.90	8.30	7.30	10.80	2.70	6.80	5.40	7.60	1.20	1.00	1.30
19	3.20	15.40	7.70	6.00	11.50	2.50	3.70	6.00	9.00	4.30	1.30	1.10
20	2.80	15.60	6.80	5.30	10.40	2.30	2.50	7.00	10.70	3.00	1.60	1.00
21	2.50	16.90	6.00	5.20	5.90	2.20	2.10	8.00	9.90	1.80	1.60	1.00
22	2.40	16.80	5.90	5.40	4.20	2.40	1.70	8.80	9.00	1.60	1.60	1.20
23	2.40	15.80	7.50	5.30	3.60	2.10	1.30	9.10	2.00	.90	1.00	1.50
24	2.30	14.30	8.80	4.50	3.00	2.60	1.20	5.00	1.50	.60	1.00	1.70
25	2.40	12.00	9.80	4.10	2.70	2.40	1.00	2.50	1.30	.50	.90	1.60
26	2.70	8.20	11.30	3.80	2.40	2.00	.90	1.80	1.00	.40	.90	2.50
27	3.30	6.30	13.40	3.90	2.30	2.10	.70	1.50	.90	.30	.90	3.70
28	5.70	6.30	15.10	4.70	2.30	3.50	.60	1.00	.80	.20	.90	3.50
29	6.00	.....	17.00	4.30	2.80	3.90	.50	.90	.70	.20	.80	3.20
30	5.40	.....	17.60	3.60	5.30	4.70	.50	.60	.50	.20	.80	2.60
31	5.00	.....	16.70	.....	3.80	.....	.60	.50	.....	.30	.....	2.00

Rating table for Oconee River at Dublin, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.2	1,530	1.2	2,410	5.0	5,470	12.0	14,620
−0.1	1,580	1.4	2,550	5.5	6,020	13.0	16,270
0.0	1,630	1.6	2,690	6.0	6,620	14.0	17,920
0.1	1,685	1.8	2,830	6.5	7,220	15.0	19,620
0.2	1,740	2.0	2,970	7.0	7,820	16.0	21,320
0.3	1,800	2.2	3,120	7.5	8,420	17.0	23,020
0.4	1,865	2.4	3,270	8.0	9,020	18.0	24,720
0.5	1,930	2.6	3,420	8.5	9,645	19.0	26,420
0.6	1,995	2.8	3,570	9.0	10,270	20.0	28,120
0.7	2,060	3.0	3,720	9.5	10,945	21.0	29,820
0.8	2,130	3.5	4,120	10.0	11,620	22.0	31,520
0.9	2,200	4.0	4,520	10.5	12,345	23.0	33,220
1.0	2,270	4.5	4,970	11.0	13,070	24.0	34,920

Table was made from measurements between 0.12 and 15.4 feet gage heights: becomes tangent above 14 feet, with a difference of 170 per tenth.

Estimated monthly discharge of Oconee River at Dublin, Ga., for 1903.

[Drainage area, 4,182 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	6,620	2,200	4,090	0.98	1.13
February	34,920	4,040	16,766	4.01	4.18
March	24,040	6,500	12,704	3.04	3.50
April	20,470	4,200	10,120	2.42	2.70
May	13,845	3,195	5,701	1.36	1.57
June	16,435	2,970	6,537	1.56	1.74
July	8,180	1,930	4,016	.96	1.11
August	10,405	1,930	3,964	.95	1.10
September	12,635	1,530	3,563	.85	.95
October	4,790	1,580	2,044	.49	.56
November	4,360	1,800	2,501	.60	.67
December	4,280	1,995	2,634	.63	.73
The year	34,920	1,530	6,220	1.49	19.94

OCONEE RIVER AT MILLEDGEVILLE, GA.

This station was established August 22, 1903, by M. R. Hall, although several discharge measurements were made before that time. The first one was made by C. C. Babb on October 19, 1895. The bench mark to which the present gage is referred was used to get the water height at the time of each of these measurements.

The station is located at the iron highway bridge in the eastern part of Milledgeville, which consists of 4 spans, 100 feet, 150 feet, 150 feet, and 80 feet long, beginning at the right bank end, and short wooden trestles about 25 feet long at each end.

At low water the river is about 300 feet wide, including 2 piers, and often a sand bar of considerable extent in the third span. This bar sometimes practically stops the third-span channel, leaving the river about 200 feet wide. The bed is sandy and shifting, and the water is shallow and swift. These conditions are unfavorable to accurate measurements as well as a constant rating. The channel is only slightly curved. Both banks are high and will not overflow. Measurements are made from the downstream side of the bridge, and the initial point is the end of the iron bridge at the right bank, downstream. The chain gage is attached to the downstream-side fencing of the bridge. The pulley is fastened to the top plank at a point 138.3

feet from the initial point for soundings. The zero of the scale is 2 feet to the right of the pulley. The length of the chain from the end of the weight to the marker is 46.03 feet. The gage is read once daily by J. A. Brooks.

Bench mark No. 1 is the top of the third crossbeam from the pier on the east bank, downstream end. It is 39 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Oconee River at Milledgeville, Ga., for 1903.

Date.	Hydrographer.	Gage Height.	Discharge.
		Feet.	*Second-feet.*
August 22	M. R. Hall	3.95	2,301
September 11	do	2.39	1,141
September 12	do	2.27	1,042
October 16	F. A. Murray	2.39	1,140
December 16	do	3.05	1,908
December 18	do	2.74	1,720

Mean daily gage height, in feet, of Oconee River at Milledgeville, Ga., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.50	2.50	2.55	2.70	17		17.30	3.50	2.80	2.90
2		2.45	2.50	2.55	2.65	18		8.60	5.70	3.40	2.85
3		2.40	2.40	2.55	2.65	19		5.30	3.60	3.20	2.75
4		2.40	2.40	2.65	2.65	20		3.90	3.00	2.90	2.75
5		2.35	2.40	3.90	2.75	21		3.40	2.90	2.85	3.00
6		2.40	2.30	3.80	2.75	22		3.20	2.75	2.85	2.95
7		2.40	2.25	3.70	2.75	23		3.10	2.65	2.85	2.95
8		2.20	3.10	3.20	2.70	24		3.00	2.60	2.85	3.00
9		3.50	2.65	3.10	2.65	25	3.20	2.90	2.55	2.80	3.00
10		2.50	2.60	2.70	3.40	26	3.10	2.85	2.45	2.80	3.90
11		2.50	2.40	2.85	3.40	27	3.00	2.60	2.40	2.75	3.70
12		2.30	2.25	2.70	3.20	28	2.85	2.60	2.50	2.70	3.30
13		2.10	2.20	2.85	2.95	29	2.75	2.60	2.50	2.70	3.00
14		2.45	2.35	2.85	3.00	30	2.65	2.50	2.50	2.70	2.90
15		3.40	2.30	2.85	3.10	31	2.55		2.55		2.90
16		17.30	2.40	2.80	3.10						

OCONEE RIVER NEAR GREENSBORO, GA.

This station was established July 25, 1903, by M. R. Hall. It is located at the new wagon bridge, about 5 miles west of Greensboro, on the road to Madison, Ga. The bridge is of two spans. The first one from the right bank is 80 feet long, and is not over the water except at time of floods. The main span over river is 144 feet long.

There is also 52 feet of iron trestle and about 40 feet of wooden trestle on the right bank, and 253 feet of iron trestle and about 325 feet of wooden trestle on the left bank. Ordinarily the river is about 120 feet wide. The bed is sandy and shifting. The channel is nearly straight, and the current is regular and sluggish at low stages. The right bank is high and rocky, with the exception of a low bench under the bridge and approach. The left bank is low and will overflow at a gage height of 12 to 15 feet to the end of the approach, a distance of about 600 feet, and extreme high water may pass beyond the end of the approach.

Discharge measurements are made from the downstream side of the bridge. The initial point is the end of the iron trestle on the right bank, downstream.

The boxed chain gage is bolted to the lower chord of the downstream side of the bridge 163 to 165 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 38.73 feet. The gage is read once each day by M. A. Stevens.

Bench mark No. 1 is the top of the downstream end of the second crossbeam from the right-bank pier. Its elevation is 36 feet above gage datum. Bench mark No. 2 is a copper plug set in the rock under the upstream side of the bridge opposite a point 84 feet from the initial point for soundings. Its elevation is 13.55 feet above gage datum. Bench mark No. 3 is on a hickory tree 26 feet downstream from the end of the wooden trestle on the right bank. Its elevation is 33.15 feet above gage datum. Bench mark No. 4 is the concrete foundation under the iron post below the initial point for soundings. Its elevation is 27.58 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Oconee River near Greensboro, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 12	M. R. Hall	4.00	1,521
July 25	do	1.75	783
August 28	do	1.70	665
October 9	do	1.70	690
December 2	M. R. and W. E. Hall	1.66	725

Mean daily gage height, in feet, of Oconee River near Greensboro, Ga., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.90	1.60	1.60	1.60	1.80	17	.....	4.10	8.90	1.80	1.90	1.80
2	.....	4.50	1.40	1.50	1.60	1.70	18	.....	9.60	6.80	1.70	1.70	1.70
3	.....	6.90	1.40	1.50	1.80	1.60	19	.....	13.20	5.20	1.70	1.90	1.70
4	.....	5.60	1.40	1.50	3.70	1.50	20	.....	5.80	2.60	1.60	2.00	1.60
5	.....	4.00	1.40	1.50	2.80	1.50	21	.....	3.50	2.10	1.60	2.10	1.60
6	.....	2.90	1.30	1.50	3.70	1.60	22	.....	2.90	2.20	1.50	1.80	1.80
7	.....	2.20	1.80	1.60	2.60	1.60	23	.....	2.60	2.00	1.50	1.60	1.80
8	.....	2.10	1.20	1.80	2.40	1.80	24	.....	2.10	1.90	1.50	1.60	2.40
9	.....	1.90	1.20	1.70	2.10	2.00	25	.....	1.90	1.80	1.50	1.90	2.20
10	.....	2.50	1.70	1.70	2.10	1.90	26	1.60	1.90	1.80	1.50	1.90	2.20
11	.....	2.10	1.80	1.40	1.90	1.90	27	1.60	1.80	1.70	1.50	1.80	2.00
12	.....	1.50	1.40	1.40	1.90	1.80	28	1.70	1.80	1.60	1.40	1.70	2.10
13	.....	1.50	.90	1.30	1.80	1.70	29	1.60	1.60	1.60	1.30	1.60	2.00
14	.....	4.10	1.20	1.20	1.80	1.70	30	2.00	1.50	1.60	1.30	1.60	1.80
15	.....	2.50	1.80	1.30	1.90	1.90	31	2.40	1.50	.....	1.50	.....	1.80
16	.....	5.00	10.20	4.50	1.70	2.00							

APALACHEE RIVER NEAR BUCKHEAD, GA.

This station was established February 13, 1901, by M. R. Hall. It is located at the iron wagon bridge over Apalachee River about 3½ miles north of the town of Buckhead, Ga. The bridge is a single span 103 feet long, supported by tubular piers. Its trestle approaches are about 500 feet long on the right bank and about 100 feet on the left. At ordinary stages the channel is about 80 feet wide, and it is only slightly curved above and below the bridge. The bed of the river is part rock and part sand. The current is moderately swift and is somewhat broken and irregular on account of ruins of old pier bases about 50 feet upstream. The right bank is low for a distance of 400 feet and will overflow at a gage height of 10 feet. The low portion is thickly covered with trees and a brushy growth, which will greatly retard the flood water passing over it. The left bank is high and will not overflow, except to a short distance up the steep slope. Measurements are made from the downstream side of the bridge, and the initial point is the outside edge of the iron pier, left bank, downstream. The gage is graduated to feet and tenths with brass figures and staples and consists of two parts. The first section, extending from zero to 10 feet, is fastened to a small ash tree on the left bank about 100 feet below the bridge. The second section, extending from 6 to 20 feet, is nailed to the upstream post of the last wooden bent next to the iron bridge on the right bank.

Bench mark No. 1 is the top of the iron pier from the right bank, downstream side. Its elevation is 25 feet from the zero of the gage. Bench mark No. 2 is the top of the downstream end of the first cross beam from the right bank. Its elevation is 25.50 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock 10 feet west of the upstream tubular pier on right bank and 3 feet

upstream from the line of the upper edge of the bridge. Its elevation is 3.73 feet above the zero of the gage.

The observer is G. A. T. Adams, a farmer living about one-third of a mile from the bridge. Readings are made once a day.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Apalachee River near Buckhead, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 15	M. R. Hall	2.33	444
May 27	do	1.88	361
June 12	do	3.07	643
July 25	do	1.51	266
August 28	do	1.31	214
October 9	do	1.45	237
December 1	M. R. and W. E. Hall	1.60	255

Mean daily gage height, in feet, of Apalachee River near Buckhead, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	2.50	7.80	8.80	2.70	4.00	2.20	1.20	1.10	1.70	1.20	1.90
2	2.60	3.10	7.00	5.70	2.60	10.00	2.00	3.40	.90	1.70	1.20	1.90
3	2.50	3.40	6.00	5.00	2.70	8.50	2.10	5.10	1.60	1.70	1.90	1.90
4	2.80	4.20	4.50	4.50	3.10	4.40	2.20	4.70	1.50	1.70	2.90	1.90
5	2.60	4.50	4.20	4.40	3.40	5.50	2.00	2.90	1.50	1.80	2.70	1.80
6	2.70	5.50	4.00	4.20	2.80	9.00	2.40	3.10	1.40	1.10	2.40	1.90
7	2.60	5.90	4.00	4.10	2.70	9.20	2.00	2.10	.90	1.80	2.40	1.90
8	2.40	17.00	4.00	5.00	2.60	4.50	6.20	1.90	.90	1.70	2.00	1.80
9	2.40	15.00	3.80	9.50	2.70	3.30	4.20	1.80	1.20	1.70	1.40	2.00
10	2.00	11.00	5.50	7.00	2.60	3.20	2.30	1.60	1.50	1.70	2.00	2.00
11	2.00	10.00	7.00	4.90	2.50	4.00	2.70	1.70	1.40	1.50	2.00	2.00
12	3.00	13.00	5.00	4.20	2.40	3.70	2.50	1.60	1.30	1.40	1.90	2.00
13	2.90	9.00	4.40	3.80	2.40	3.50	4.20	1.90	1.20	1.70	1.80	2.00
14	2.60	7.10	4.00	6.00	2.70	2.70	8.50	1.90	1.30	1.70	1.90	1.80
15	2.40	5.20	3.90	4.90	3.20	2.50	10.00	2.40	1.90	1.70	1.90	1.90
16	2.30	4.50	3.80	4.50	4.60	2.30	3.80	3.30	7.50	1.90	1.80	1.90
17	2.30	7.20	3.60	3.90	4.00	2.10	2.70	3.50	8.50	1.80	1.90	1.90
18	2.20	6.50	3.40	3.50	2.80	2.10	2.70	7.00	4.30	2.10	2.00	1.80
19	2.20	5.20	3.20	3.00	2.50	2.00	2.30	3.70	2.50	1.80	2.00	1.90
20	2.15	4.50	3.00	3.10	2.40	2.00	2.10	2.30	2.10	1.90	1.90	1.90
21	2.40	4.00	3.10	3.50	2.30	2.60	2.10	2.20	1.90	1.80	1.90	1.80
22	2.30	4.00	7.00	3.20	2.20	2.70	2.00	2.10	1.80	1.80	2.00	1.90
23	2.30	3.60	10.00	3.00	2.20	2.20	1.90	1.80	1.70	1.70	1.50	1.90
24	2.20	3.20	15.00	2.90	2.20	2.00	1.80	1.70	1.60	1.70	1.90	1.80
25	2.20	2.90	13.20	2.80	2.10	1.90	1.80	1.90	1.80	1.50	1.90	1.80
26	2.10	3.00	7.00	3.50	2.00	2.00	1.70	1.90	1.90	1.80	2.00	1.80
27	2.00	3.10	4.90	3.40	1.90	2.80	1.60	1.70	1.80	1.80	2.00	1.70
28	3.00	6.20	4.10	3.00	1.80	2.80	1.50	1.60	1.50	1.70	2.00	1.70
29	2.80	.....	4.50	2.80	1.90	3.00	1.40	1.30	1.60	1.50	1.50	1.80
30	2.50	.....	8.00	2.70	2.00	3.40	1.40	1.50	1.70	1.40	1.90	1.90
31	2.40	.....	11.00	.....	2.00	.....	1.30	1.40	.....	1.30	.....	1.90

Rating table for Apalachee River near Buckhead, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	180	2.3	442	4.2	965	8.0	2,010
1.1	191	2.4	470	4.4	1,020	8.5	2,147
1.2	203	2.5	497	4.6	1,075	9.0	2,285
1.3	216	2.6	525	4.8	1,130	9.5	2,422
1.4	231	2.7	552	5.0	1,185	10.0	2,560
1.5	248	2.8	580	5.2	1,240	10.5	2,697
1.6	267	2.9	607	5.4	1,295	11.0	2,835
1.7	288	3.0	635	5.6	1,350	11.5	2,972
1.8	310	3.2	690	5.8	1,405	12.0	3,110
1.9	333	3.4	745	6.0	1,460	13.0	3,385
2.0	360	3.6	800	6.5	1,597	14.0	3,660
2.1	388	3.8	855	7.0	1,735		
2.2	415	4.0	910	7.5	1,872		

Table depends upon measurements made between 1.31 and 6.45 feet gage height. Beyond these points the table is uncertain. Above 2 feet the 1901, 1902, and 1903 tables are the same.

Estimated monthly discharge of Apalachee River near Buckhead, Ga., for 1903.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	635	360	481	1.09	1.26
February	4,485	497	1,522	3.46	3.60
March	3,935	635	1,406	3.20	3.69
April	2,422	552	1,009	2.29	2.55
May	1,075	310	520	1.18	1.36
June	2,560	334	854	1.94	2.16
July	2,560	216	593	1.35	1.56
August	1,735	203	495	1.12	1.29
September	2,147	170	407	.93	1.04
October	388	191	287	.65	.75
November	607	203	348	.79	.88
December	360	288	328	.75	.86
The year	4,485	170	688	1.56	21.00

SOUTH RIVER NEAR LITHONIA, GA.

This station was established August 17, 1903, by F. A. Murray. The station is located a short distance above Albert Shoals, 6 miles south of Lithonia, Ga. The gage is a vertical 10-foot rod fastened to a tree on the right bank just below the bridge. It is read once each day by W. N. New. Discharge measurements are made from the 3-span wooden highway bridge. The initial point for soundings is the end of the bridge on the right bank, upstream side. The channel above the station is nearly straight for about 300 feet, and the current is sluggish, being held back by rock ledges below the station. Below the station the channel curves slightly and the current is sluggish for about 400 feet, at which point the shoals begin. The right bank is low and overflows at a gage height of 9 or 10 feet into a second channel, which has a width at high water of about 200 feet. The left bank is high and rocky and does not overflow. The bottom is solid rock.

Bench mark No. 1 is the top of the upstream end of the first wooden crossbeam from the right bank. Its elevation is 15 feet above the zero of the gage. Bench mark No. 2 is the center of a wire nail driven horizontally in the upstream side of the base of a willow tree on the left bank about 40 feet upstream from the bridge. Its elevation is 4 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of South River near Lithonia, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 17	F. A. Murray	3.55	179
September 10	M. R. Hall	3.46	120
Do	do	3.43	104
October 5	do	3.40	104

Mean daily gage height, in feet, of South River near Lithonia, Ga., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.50	3.50	3.50	3.50	17	3.50	3.90	3.50	3.50	3.50
2	.....	3.40	3.50	3.50	3.50	18	4.10	3.60	3.60	3.60	3.50
3	.....	3.50	3.50	3.50	3.50	19	3.80	3.50	3.50	3.50	3.50
4	.....	3.40	3.50	4.60	3.50	20	3.60	3.40	3.50	3.50	3.60
5	.....	3.40	3.50	4.00	3.50	21	3.50	3.50	3.50	3.50	3.50
6	.....	3.40	3.50	3.60	3.50	22	3.60	3.50	3.50	3.50	3.50
7	.....	3.50	3.50	3.60	3.50	23	3.40	3.50	3.50	3.50	3.50
8	.....	3.40	3.50	3.60	3.50	24	3.50	3.50	3.50	3.50	3.50
9	.....	3.40	3.50	3.60	3.50	25	3.50	3.50	3.50	3.50	3.50
10	.....	3.40	3.50	3.60	3.50	26	3.50	3.50	3.50	3.50	3.60
11	.....	3.50	3.50	3.60	3.50	27	3.60	3.50	3.50	3.60	3.50
12	.....	3.40	3.50	3.50	3.50	28	3.50	3.50	3.50	3.60	3.50
13	.....	3.50	3.50	3.50	3.60	29	3.60	3.50	3.50	3.50	3.50
14	.....	3.40	3.50	3.60	3.50	30	3.60	3.50	3.50	3.50	3.50
15	.....	4.50	3.50	3.50	3.50	31	3.40	.....	3.50	.....	3.50
16	.....	4.40	3.50	3.50	3.50						

OCMULGEE RIVER AT MACON, GA.

Ocmulgee River rises in the north-central part of Georgia and flows in a southeasterly direction, joining the Oconee south of Mount Vernon to form Altamaha River. The drainage area has the same general features as that of the Oconee. A station was established at Macon, Ga., by the United States Weather Bureau, on January 21, 1893. Discharge measurements were begun by the United States Geological Survey in 1895, and a wire gage was established on the bridge of the Macon, Dublin and Savannah Railroad, and was set on the same datum as the Weather Bureau gage. For a time gage height records were maintained by the Geological Survey, as the Weather Bureau records were for a part of the year only and were discontinued altogether from June 30, 1897, to June 1, 1899. Since June 1, 1899, the Weather Bureau gage height records have been taken continuously, and have been furnished to the Geological Survey.

The gage is a heavy timber graduated to feet and tenths by copper nails and is bolted to the downstream portion of the right bank stone pier of the Central of Georgia Railroad bridge. Discharge measurements are made from the downstream side of the Fifth Street Bridge, an iron bridge of two 190-foot spans, located about 500 feet above the railroad bridge to which the gage is attached. The initial point for soundings is the end of the iron hand rail of the footway at the right bank on the downstream side. The channel is straight and without obstructions, except one bridge pier. The banks are high and not subject to overflow. The bed of the river is soft and changeable. The station was a fairly good one until the spring of 1902, when the bed of the stream (which is of shifting sand) below the station changed to such an extent as to make the current very sluggish at low stages.

Bench mark No. 1 is the top of the iron rim of the sidewalk 80 feet from the initial point for soundings. Its elevation is 34.35 feet above the zero of the gage. It was determined by measuring down to the water surface. Bench mark No. 2 is the top of a cast-iron post at the end of the hand rail on the right bank, downstream side, of the Fifth street wagon bridge. Its elevation is 37.37 feet above the zero of the gage. Bench mark No. 3 is the top of the downstream side of the capstone of the right bank abutment of the Central of Georgia Railroad bridge. Its elevation is 32.30 feet above the zero of the gage. Bench mark No. 4 is an aluminum tablet on the wall at the west side of the door of the United States Government building at the Mulberry street front. This bench mark is marked 334 feet and has an elevation of 64.37 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Ocmulgee River at Macon, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 26	M. R. Hall	4.00	1,794
April 4	J. M. Giles	9.00	5,118
April 2	do	11.30	7,244
April 21	E. C. Murphy	7.88	4,396
July 14	M. R. Hall	11.00	7,676
Do	F. A. Murray	11.00	7,314
August 24	do	3.61	1,382
October 15	J. M. Giles	2.22	926
Do	do	2.28	915
September 30	F. A. Murray	2.55	1,022
Do	do	2.56	1,057
November 13	M. R. Hall	2.84	1,236
December 21	J. M. Giles	2.88	1,264
Do	do	2.95	1,329

Mean daily gage height, in feet, of Ocmulgee River at Macon, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.80	4.20	14.30	14.30	5.30	7.20	4.40	4.10	2.90	2.30	2.20	2.50
2	4.50	4.00	12.80	11.40	5.10	13.50	4.30	3.50	2.70	2.30	2.30	2.40
3	4.70	4.00	9.30	9.90	5.20	11.50	4.40	3.70	2.60	2.40	2.50	2.30
4	4.70	4.30	8.30	9.00	6.10	9.40	4.60	5.60	2.40	2.40	2.80	2.30
5	5.20	5.70	9.50	8.90	6.60	12.90	4.90	6.30	2.00	2.40	3.50	2.40
6	4.90	7.80	10.00	8.10	6.40	17.40	4.40	7.40	2.50	2.50	4.10	2.70
7	4.60	6.70	8.80	8.30	5.80	12.90	4.40	5.50	2.30	2.50	3.20	2.80

Mean daily gage height, in feet, of Ocmulgee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	4.40	20.00	7.80	7.70	7.00	12.30	4.90	3.90	2.20	2.50	3.00	2.80
9	4.20	20.70	7.70	12.20	6.50	8.80	6.00	3.50	2.20	2.60	2.90	2.90
10	4.00	18.40	12.60	13.00	6.00	8.20	5.60	3.40	2.10	2.60	2.60	3.30
11	3.90	15.75	11.20	10.00	5.50	6.90	4.50	3.20	2.10	2.50	2.60	3.30
12	4.90	17.60	11.40	8.90	5.30	6.40	7.30	3.10	2.10	2.40	2.50	3.20
13	5.40	16.30	11.20	7.70	5.10	5.80	6.60	3.50	2.20	2.30	2.90	2.90
14	4.90	12.90	9.30	8.90	5.30	5.30	10.20	3.60	2.20	2.40	2.80	2.90
15	4.40	10.60	8.10	8.80	7.20	5.10	11.00	5.90	9.90	2.40	2.70	3.20
16	4.20	10.20	9.20	7.70	11.00	4.70	7.40	7.30	14.70	2.30	2.80	2.90
17	4.20	16.30	8.70	6.90	8.20	4.50	5.30	7.30	13.00	2.90	2.70	2.70
18	4.10	16.50	7.50	6.60	6.30	4.40	4.60	5.70	8.30	4.90	2.90	2.70
19	3.90	14.10	6.90	6.30	5.70	4.40	4.30	9.80	5.50	3.50	2.90	2.60
20	3.80	11.10	6.50	6.20	5.20	4.20	4.20	11.20	4.40	3.10	3.10	2.40
21	3.80	9.40	6.40	8.20	5.10	4.10	3.90	5.70	3.80	2.90	3.00	2.90
22	3.80	7.90	11.50	7.30	4.90	4.40	3.90	5.10	3.60	2.70	2.90	3.20
23	3.80	7.30	15.20	6.20	4.70	4.50	3.60	4.10	3.00	2.40	2.70	3.10
24	3.80	6.90	18.30	5.80	4.90	4.40	3.50	4.30	3.20	2.40	2.80	2.90
25	4.00	6.30	18.30	5.70	4.50	4.20	3.40	4.00	3.20	2.40	2.80	2.60
26	4.10	6.20	15.60	6.60	4.30	4.00	3.40	3.20	3.10	2.30	2.70	3.70
27	4.80	6.10	11.30	6.50	4.20	4.20	3.30	3.10	3.00	2.30	2.60	3.40
28	5.10	8.00	9.20	5.90	4.70	5.30	3.20	2.90	3.00	2.30	2.60	3.40
29	5.10	.....	8.30	5.60	5.30	6.70	3.40	2.80	2.70	2.30	2.60	3.20
30	5.30	.....	14.50	5.40	4.70	5.40	3.20	2.70	2.50	2.30	2.50	2.80
31	4.70	.....	16.10	.....	4.60	.....	5.30	2.70	.....	2.30	.....	2.70

Rating table for Ocmulgee River at Macon, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	810	3.3	1,505	5.2	2,640	7.8	4,290
2.1	860	3.4	1,560	5.4	2,760	8.0	4,420
2.2	910	3.5	1,620	5.6	2,880	8.5	4,770
2.3	960	3.6	1,680	5.8	3,000	9.0	5,170
2.4	1,010	3.7	1,740	6.0	3,120	9.5	5,570
2.5	1,065	3.8	1,800	6.2	3,250	10.0	6,060
2.6	1,120	3.9	1,860	6.4	3,380	10.5	6,700
2.7	1,175	4.0	1,920	6.6	3,510	11.0	7,380
2.8	1,230	4.2	2,040	6.8	3,640	12.0	9,020
2.9	1,285	4.4	2,160	7.0	3,770	13.0	11,140
3.0	1,340	4.6	2,280	7.2	3,900	14.0	13,900
3.1	1,395	4.8	2,400	7.4	4,030		
3.2	1,450	5.0	2,520	7.6	4,160		

Table made from measurements between 2.22 and 13 feet gage height. For rating table above 14 feet see the 1902 table. Table only approximate above 13 feet.

Estimated monthly discharge of Ocmulgee River at Macon, Ga., for 1903.

[Drainage area, 2,425 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,760	1,800	2,191	0.90	1.04
February	42,040	1,920	11,845	4.89	5.09
March	31,960	3,380	9,561	3.94	4.54
April	15,160	2,760	5,003	2.06	2.30
May	7,380	2,040	2,991	1.23	1.42
June	28,180	1,920	4,962	2.05	2.29
July	7,380	1,450	2,558	1.05	1.21
August	7,660	1,175	2,460	1.01	1.16
September	16,840	810	2,380	.98	1.09
October	2,460	960	1,110	.46	.53
November	1,980	910	1,235	.51	.57
December	1,740	960	1,272	.52	.60
The year	42,040	810	3,964	1.63	21.84

OCMULGEE RIVER NEAR FLOVILLA, GA.

A station was established on July 26, 1901, on Ocmulgee River at Lamars Ferry, one-half mile below Lamar's mill and 5 miles east of Flovilla, Ga. The object of this station was to compare the discharge of the river at this point with its discharge below at Macon through the low-water season.

The gage consisted of a ⅞ by 5 inch by 10 foot poplar board, graduated to feet and tenths with brass figures, staples, and tacks. The rod was nailed to a 16-foot pine plank, which was spiked to an ash tree 25 feet below the ferry landing. The tree was graduated with nails 1 foot apart, extending the gage up to 20 feet above datum.

The gage and bench marks were washed away by a flood on February 27, 1902. The station was reestablished June 18, 1903, at Lamars Ferry, by M. R. Hall. The vertical-timber gage is in two sections. The first section is a 1 by 4 inch board, reading from 0 to 5 feet, nailed to a 2 by 6 inch scantling which is spiked to a willow tree at the mouth of a small branch about 20 feet above the ferry landing on the right bank. The second section, reading from 5 to 15 feet, is nailed to an ash tree about 60 feet from the river up the same branch. No attempt was made to place this gage on the same datum of the old one. Measurements are made from the ferry boat. The

initial point for soundings is the windlass on the right bank. The channel is straight for 1,000 feet above and 5,000 feet below the station. The current is swift and regular; the right bank is high, but overflows at extreme high water. The left bank is somewhat lower. The bed of the stream is sandy and shifting, and there is but one channel.

Bench mark No. 1 is a nail driven in a large cottonwood tree about 200 feet from the river on the branch on which the gage is located. Its elevation is 14 feet above the zero of the gage. Bench mark No. 2 is a cross in the solid rock, 100 feet uphill from the first bench mark and 140 feet north from the wagon road, at a point 250 feet west of the ferry. Its elevation is 34.24 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Ocmulgee River near Flovilla, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 18	M. R. Hall	2.00	1,383
August 25	F. A. Murray	1.61	893
September 29	do	1.35	771
October 13	J. M. Giles	1.10	701
November 12	M. R. Hall	1.78	1,070
December 19	J. M. Giles	1.61	879

Mean daily gage height, in feet, of Ocmulgee River near Flovilla, Ga., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	1.60	1.20	1.30	1.20	1.50	17	2.90	3.30	6.50	1.80	1.50	1.70
2	1.90	1.40	1.10	1.30	1.20	1.50	18	2.40	7.50	3.90	1.80	1.70	1.70
3	2.30	2.10	1.10	1.30	1.30	1.40	19	2.30	6.10	2.80	1.70	1.70	1.60
4	2.90	4.00	1.30	1.20	1.40	1.70	20	2.10	3.40	2.40	1.50	1.80	1.70
5	2.70	3.40	1.10	1.20	3.20	1.60	21	1.90	2.70	1.90	1.40	1.50	2.00
6	2.10	2.70	.90	1.20	2.20	1.60	22	1.70	2.40	1.80	1.30	1.50	2.00
7	2.60	2.10	.90	1.20	2.10	1.60	23	1.60	2.10	1.70	1.20	1.60	1.90
8	3.20	1.70	.90	1.30	2.30	1.70	24	1.50	1.90	1.60	1.20	1.60	1.70
9	3.80	1.50	.80	1.30	1.50	1.60	25	1.50	1.60	1.50	1.10	1.70	1.70
10	2.80	1.40	.70	1.30	1.60	2.10	26	1.40	1.50	1.50	1.10	1.60	2.00
11	3.20	1.30	.90	1.20	1.40	2.00	27	1.30	1.40	1.40	1.10	1.60	2.30
12	5.30	1.70	.80	1.10	1.80	1.80	28	1.20	1.30	1.40	1.20	1.50	1.90
13	4.50	1.30	.80	1.10	1.70	1.70	29	1.30	1.20	1.40	1.20	1.50	1.80
14	9.50	3.80	1.10	1.00	1.60	1.90	30	1.50	1.10	1.30	1.20	1.50	1.70
15	6.60	5.20	6.20	.90	1.50	1.80	31	2.00	1.20	.....	1.20	.....	1.70
16	4.00	9.20	9.90	1.20	1.50	1.70							

Rating table for Ocmulgee River near Flovilla, Ga., from July 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.7	635	2.0	1,120	3.3	2,010	5.0	3,200
.8	648	2.1	1,185	3.4	2,080	5.5	3,550
.9	663	2.2	1,250	3.5	2,150	6.0	3,900
1.0	680	2.3	1,315	3.6	2,220	6.5	4,250
1.1	700	2.4	1,380	3.7	2,290	7.0	4,600
1.2	725	2.5	1,450	3.8	2,360	7.5	4,950
1.3	755	2.6	1,520	3.9	2,430	8.0	5,300
1.4	790	2.7	1,590	4.0	2,500	8.5	5,650
1.5	832	2.8	1,660	4.1	2,570	9.0	6,000
1.6	880	2.9	1,730	4.2	2,640	9.5	6,350
1.7	935	3.0	1,800	4.3	2,710	10.0	6,700
1.8	995	3.1	1,870	4.4	2,780		
1.9	1,055	3.2	1,940	4.5	2,850		

Above 2.40 feet gage height the curve becomes a tangent with difference of 70 per tenth.

Estimated monthly discharge of Ocmulgee River near Flovilla, Ga., for 1903.

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July	6,350	725	1,681	1.12	1.29
August	6,140	700	1,635	1.09	1.26
September	6,630	635	1,285	.86	.96
October	995	663	754	.50	.58
November	1,940	725	932	.62	.69
December	1,450	790	981	.65	.75

ALCOVY RIVER NEAR COVINGTON, GA.

This station was established on April 30, 1901. It is located about 3 miles east of Covington, at a low wooden bridge which is often under water. The gage is a vertical rod 10 feet long, graduated to feet and tenths, marked by tacks and brass figures. It is spiked to a birch tree on the left bank of the river 2 feet from the upstream side of the bridge. The observer is Stephen Belcher, a farmer living near, who

is paid by the Georgia geological survey. Discharge measurements are made from the upstream side of a low two-span wooden bridge about 100 feet long. The initial point for soundings is the end of the bridge floor on the left bank, upstream side. The banks are low and liable to overflow. The ground on the right bank is low and swampy for several hundred yards and is flooded by a moderate rise. The bed of the stream is sandy and shifting, and the water is sluggish at low stages.

Bench mark No. 1 is a notch and nail in a maple tree on the right bank, about 15 feet from the upper side of the bridge. Its elevation is 5.91 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in the solid rock on the north edge of the side ditch on the upstream side of the road, 100 feet from the end of the bridge, on the left bank of the river. Its elevation is 7.82 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Alcovy River near Covington, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 11	M. R. Hall	4.41	575
May 28	do	3.48	385
July 24	do	1.92	174
August 27	do	1.60	127
October 8	do	1.50	120
November 14	F. A. Murray	1.90	157
December 19	do	1.85	155

Mean daily gage height, in feet, of Alcovy River near Covington, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	2.50	4.90	6.30	3.00	7.00	2.80	1.90	1.20	1.50	1.70	1.90
2	3.00	2.50	5.50	5.70	3.00	6.70	2.60	2.50	1.20	1.40	1.70	1.90
3	2.90	2.70	5.20	5.00	3.00	5.70	2.70	4.50	1.20	1.40	1.80	1.80
4	3.00	3.00	4.70	4.80	5.70	5.20	2.80	3.80	1.20	1.60	2.30	1.80
5	2.90	3.60	4.50	4.70	5.00	5.40	2.70	3.00	1.40	1.60	2.70	1.80
6	2.80	4.00	4.20	4.50	4.50	6.10	2.60	2.70	1.30	1.50	3.00	2.20
7	2.70	4.40	4.20	4.30	4.00	6.00	4.50	2.60	1.20	1.50	2.50	2.10
8	2.60	8.00	4.10	4.80	3.40	5.50	5.50	2.40	1.20	1.50	2.00	2.00
9	2.50	7.50	4.00	6.10	3.50	4.50	4.40	1.80	1.20	1.50	1.90	2.10
10	2.30	7.00	4.50	5.90	3.30	4.00	3.70	1.70	1.20	1.50	1.90	2.50
11	2.80	6.50	4.40	5.60	3.10	3.80	4.80	1.60	1.10	1.40	1.90	2.20
12	3.00	6.50	4.30	4.50	3.00	3.50	4.00	1.60	1.10	1.40	1.90	2.00
13	3.30	6.60	4.70	4.40	2.90	3.30	6.50	1.60	1.00	1.40	1.90	2.00

Mean daily gage height, in feet, of Alcovy River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
14	2.90	6.20	5.10	4.70	3.30	3.00	6.30	2.20	1.20	1.40	1.90	2.10
15	2.80	5.30	4.70	4.50	4.00	2.90	5.10	3.00	3.30	1.40	1.90	2.50
16	2.70	4.90	4.60	4.30	4.20	2.80	4.20	4.00	4.40	1.40	1.90	2.30
17	2.60	6.50	4.50	4.00	4.00	2.70	3.20	4.50	4.70	1.40	2.50	2.20
18	2.50	6.70	4.00	3.80	3.50	2.60	2.90	3.50	4.00	2.00	2.20	2.00
19	2.40	6.60	3.80	3.80	3.10	2.40	2.70	2.40	3.70	1.90	2.20	1.80
20	2.30	5.40	3.70	3.70	2.90	2.40	2.50	2.00	2.40	1.80	2.00	2.00
21	2.20	4.80	3.80	3.60	2.80	3.00	2.30	2.40	2.20	1.70	2.00	2.20
22	2.20	4.60	5.50	3.40	2.70	2.80	2.10	3.60	2.00	1.60	2.00	2.50
23	2.20	4.30	7.50	3.10	2.60	2.60	2.00	3.00	1.90	1.60	2.00	2.20
24	2.40	4.00	8.60	2.00	2.50	2.40	1.90	2.50	1.80	1.60	2.00	2.10
25	2.50	3.80	7.40	2.00	2.50	2.30	1.90	2.00	1.70	1.50	2.00	2.00
26	2.50	3.70	6.10	2.90	2.50	2.20	2.90	1.70	1.70	1.50	2.00	2.00
27	2.80	3.60	5.30	3.30	3.30	3.60	2.70	1.60	1.80	1.50	1.90	2.50
28	3.10	4.30	4.90	3.50	3.50	3.60	2.60	1.50	1.70	1.60	1.90	2.40
29	3.00	.....	4.20	3.30	3.10	3.20	2.40	1.40	1.60	1.60	1.90	2.30
30	2.90	.....	5.70	3.10	2.80	3.00	2.00	1.30	1.50	1.50	1.90	2.20
31	2.60	.....	6.20	.....	2.70	.....	2.00	1.30	.....	1.50	.....	2.10

Rating table for Alcovy River near Covington Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	88	2.3	206	3.6	410	4.9	670
1.1	94	2.4	218	3.7	430	5.0	690
1.2	100	2.5	232	3.8	450	5.1	710
1.3	107	2.6	246	3.9	470	5.2	730
1.4	114	2.7	260	4.0	490	5.3	750
1.5	122	2.8	274	4.1	510	5.4	770
1.6	130	2.9	290	4.2	530	5.5	790
1.7	140	3.0	306	4.3	550	5.6	810
1.8	150	3.1	322	4.4	570	5.7	830
1.9	160	3.2	338	4.5	590	5.8	850
2.0	170	3.3	356	4.6	610	5.9	870
2.1	182	3.4	374	4.7	630	6.0	890
2.2	194	3.5	392	4.8	650		

At about 6 feet gage height the right bank overflows for a width of about 1,000 feet. Bank is covered by a thick swamp growth, so the velocity is probably small.

Estimated monthly discharge of Alcovy River near Covington, Ga., for 1903.

[Drainage area, 228 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	356	194	262	1.15	1.33
February	1,290	232	691	3.03	3.16
March	1,410	430	689	3.02	3.48
April	950	170	535	2.35	2.62
May	830	232	371	1.63	1.88
June	1,090	194	468	2.05	2.29
July	990	160	375	1.64	1.89
August	590	107	244	1.07	1.23
September	630	88	186	.82	.91
October	170	114	126	.55	.63
November	306	140	178	.79	.88
December	232	150	185	.81	.93
The year	1,410	88	359	1.58	21.23

MISCELLANEOUS MEASUREMENTS IN ALTAMAHA RIVER DRAINAGE BASIN.

Ocmulgee River.—At Bridges Ferry, near Berner, Ga., this stream was discharging 1,535 second-feet on June 16, 1903; gage height, 3.77 feet. The bench mark is a nail in birch tree at upper side of ferry landing, on right bank; elevation, 10.91 feet above datum.

Pendleton Creek.—This stream was measured at Gordon Bridge, 3½ miles from Lyons, Ga. The bench mark is a spike in a tupelo tree on right bank, 30 feet below bridge.

Discharge measurements of Pendleton Creek at Gordon Bridge, 3½ miles from Lyons, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
June 8	5.30	1,071
October 7	11.60	100
Do	11.25	104

Ohoopee River.—At Janill Bridge, near Ohoopee, Ga., this stream was discharging 1,481 second-feet on June 8, 1903, when the water surface was 7.1 feet below the top of crossbeam, 58 feet from end of hand rail, on right bank going downstream.

Yellow River.—At Woods Bridge, near Almon, Ga., this stream was discharging 79 second-feet on September 12, 1903, when the water surface was 17.46 feet below top of crossbeam, 75 feet from right end of bridge going downstream.

Yellow River.—At wagon bridge near Lithonia, Ga., this stream was discharging 104 second-feet on October 5, 1903, when the water surface was 16.25 feet below top of wooden stringer on downstream side of bridge, at inside face of right-bank stone abutment.

Little River.—This stream was measured at wagon bridge 6¼ miles northwest of Eatonton, Ga. The bench mark is top of bridge floor, 20 feet from end of bridge, on left bank going upstream.

Discharge measurements of Little River at wagon bridge 6¼ miles northwest of Eatonton, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
October 18	8.73	118
December 17	9.07	88

Swift Creek.—Near Lyons, Ga., this stream was discharging 31 second-feet on October 7, 1903.

Ocmulgee River.—This stream was measured at Holton, Ga. The bench mark is two nails in upstream side of birch tree 20 feet above old ferry landing, right bank.

Discharge measurements of Ocmulgee River at Holton, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
October 14	7.1	893
Do	7.0	963

Indian Creek.—This stream was measured at wagon bridge at Hudson's mill, 6 miles northwest of Eatonton, Ga. The bench mark is at top of bridge floor, 27½ feet from end of hand rail, right bank, upstream.

Discharge of Indian Creek at wagon bridge at Hudson's mill, 6 miles northwest of Eatonton, Ga., 1903.

Date.	Height of bench mark above water.	Discharge
	Feet.	*Second-feet*
October 18	8.79	85
December 17	9.10	49

Sanford Creek.—At wagon bridge, 3 miles from Eatonton, Ga., this stream was discharging 3.6 second-feet on December 17, 1903, when the water surface was 5.44 feet below bridge floor 21 feet from post on right bank.

Glady Creek.—At wagon bridge, 3½ miles from Eatonton, Ga., this stream was discharging 7 second-feet on December 17, 1903, when the water surface was 6.14 feet below bridge floor 60 feet from right end of bridge, going upstream.

Town Creek.—At wagon bridge, 1 mile east of Eatonton, Ga., this stream was discharging 2.7 second-feet on December 18, 1903, when the water surface was 8.57 feet below top of bridge floor 24 feet from right end of bridge, going downstream.

EASTERN GULF DRAINAGE.

The rivers flowing into the eastern portion of the Gulf of Mexico are for the most part similar in character to those in the southern Atlantic drainage, though in their lower courses their flow is usually more sluggish. In this report the rivers in this section from which the United States Geological Survey has obtained data during 1903 have been grouped into the following drainage areas: The Apalachicola, the Mobile, and the Pearl.

APALACHICOLA RIVER DRAINAGE BASIN.

Apalachicola River is formed by the union of Flint and Chattahoochee rivers at the Georgia-Florida line. It flows in a southerly direction through Florida to the Gulf of Mexico. It is navigable, and boats run up Flint River to Albany, Ga., and up the Chattahoochee River to Columbus, Ga.

Flint River rises a few miles south of Atlanta, Ga., in Fulton County. It flows in a southerly direction to Talbot County, southeasterly to Macon County, southerly to Worth County, and southwesterly to Apalachicola River. It drains the south-central portion of Georgia, extending from Atlanta south to the Florida line. The tributaries to Flint River are mainly large creeks with much fall.

The principal ones among these are Whitewater, Redoak, Big Potato, Muckalee, Kinchafoonee, Ichawaynochaway, and Spring creeks.

Flint River has many good water powers on its course. Between a point opposite Woodbury, Ga., and a point opposite Knoxville, Ga., in Crawford County, a distance of about 45 miles, the river falls 334 feet. Very little of its power is yet developed.

Chattahoochee River rises in the Blue Ridge, in White County, and flows in a southwesterly direction until it reaches the Alabama line at the southwest corner of Troup County, Ga. From there it flows in a southerly direction, forming the western boundary of Georgia, until it flows into Apalachicola River at the southern boundary of the State. It drains almost all of the north-central, middle-west, and southwest portions of Georgia, and has a drainage area of 4,900 square miles at Columbus, Ga., which is at the fall line.

Soque River joins the Chattahoochee on the western edge of Habersham County. This river rises in Habersham County and flows in a southwesterly direction. It has considerable fall, dropping as much as 40 feet within a few hundred feet.

Farther down the Chattahoochee, at the west boundary of Hall County, Chestatee River enters. It rises in Lumpkin County and flows in a southerly direction through a very hilly and steep country and has much fall all along its course.

From its source down to Columbus the Chattahoochee River is an excellent water-power stream. From the lower edge of Lumpkin County down to Columbus, Ga., there is a fall of over 850 feet, 366 feet of this fall being between Westpoint and Columbus. All along its course there are many small tributaries flowing from a high, hilly country. These have much fall, and many small water powers are available.

During 1903 the United States Geological Survey maintained the following stations in this basin, under the direction of M. R. Hall: On Flint River at Albany, and near Woodbury, Ga.; on Kinchafoonee and Muckalee creeks near Albany, Ga.; on Chattahoochee River at Westpoint, at Oakdale, near Norcross, and near Gainesville, Ga.

FLINT RIVER AT ALBANY, GA.

This station was originally established by the United States Weather Bureau on April 10, 1893, and has been maintained from that date to the present. The gage was washed out and replaced in 1898. It was again injured in 1902, and was replaced by a new gage on June 17, 1902, which was read for the first time on June 18. The new gage was set 9 inches, or seventy-five hundredths of a foot, lower than the old gage. The gage as it existed prior to June 17, 1902, is described in Water-Supply Paper No. 48, on page 156. R. V. Watson was employed by the Weather Bureau to make and set the

new gage, and it appears from Mr. Watson's description of this gage on June 17, 1902, that a certain bench mark cut in the lower iron pier of the county bridge and described in Paper No. 48, above referred to, as being 10 feet above zero of gage, was in reality only 9 feet and 3 inches above the zero of the old gage. As Mr. Watson set the new gage 10 feet below this bench mark, its zero is 9 inches lower than that of the old gage. The gage heights have been corrected from January 1 to June 17, 1902, inclusive, to correspond with the new gage, so that one rating table will apply to the whole year.

Albany station is and has always been a Weather Bureau station, and John E. Clark has been the observer for years. Discharge measurements were begun by the United States Geological Survey in 1901.

The following is Mr. Watson's description of the present gage: The name of the bridge to which the gage is attached is the Dougherty County Flint River bridge, located at Albany, Ga., about 700 feet below the Atlantic Coast Line Railway bridge. The gage is in three parts or sections. No. 1 is attached to the crib around the middle piers (the crib is filled with rocks, being 30 by 14 feet), and extends about 3 feet above ordinary low water. This section reads to 4 feet above zero. It is securely spiked to the wooden crib. Section No. 2 is securely spiked to a green cypress tree just above the bridge on the west bank of the river, and reads from 2 to 17 feet above the zero on No. 1. No. 3 is securely spiked to a cedar post 16 feet high, the post being put 3 feet into the firm ground. This section begins at 17 feet above the zero on No. 1 and reads to 32 feet, which is about 2½ feet above any high water known since 1840. The gage is subdivided into feet and tenths, and is read once each day by D. W. Brosnan. Discharge measurements are made from the two-span railroad bridge, with 475 feet of trestle approach on the right bank and 240 feet on the left bank.

The initial point for soundings is the center of the tubular iron pier on the upstream side of the bridge on the left bank. The channel above the station is straight for about 1,000 feet and is rough. Below the station the channel is straight for 700 feet. The river overflows both banks, but only under the approaches to the bridge. The bed is constant, but is rough, and the current is irregular.

Bench mark No. 1 is a copper plug set in the downstream corner of the brick abutment on the right bank, under the Dougherty County bridge. Its elevation is 33.81 feet above the zero of the gage. Bench mark No. 2 is the top of the first crossbeam from the right bank, upstream end of the railroad bridge. Its elevation is 43.20 feet above the zero of the gage. Bench mark No. 3 is a chisel mark on the tubular pier of the wagon bridge on the right bank, downstream side. Its elevation is 10 feet above the zero of the gage. Bench mark No. 4 is the top of the third granite block of the Confederate monument at the center of Jackson and Pine streets. This is at the bottom of the polished

block which bears the inscription. Its elevation is 61.09 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Flint River at Albany, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	F. A. Murray	13.68	18,634
May 21	M. R. Hall	16.80	23,120
July 3	F. A. Murray	5.65	7,744
October 14	M. R. Hall	1.90	3,484
September 18	do	13.06	16,641
December 22	F. A. Murray	3.25	5,035

Mean daily gage height, in feet, of Flint River at Albany, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.10	4.50	8.10	14.40	5.90	4.80	6.50	2.40	2.50	2.60	1.70	3.10
2	3.50	4.90	7.00	13.70	4.60	4.40	6.40	2.30	2.40	2.50	1.70	2.90
3	3.00	5.30	7.90	13.00	4.70	4.50	5.80	2.20	2.40	2.40	1.90	2.80
4	3.20	5.60	8.50	13.00	4.00	5.60	4.70	2.10	2.80	2.30	2.90	2.80
5	3.40	5.40	9.60	13.00	3.90	7.30	4.00	2.50	2.20	2.20	5.00	2.70
6	3.90	5.10	13.50	12.60	3.70	9.00	4.60	3.40	2.00	2.10	7.50	2.70
7	4.20	5.10	14.50	11.50	4.50	11.40	4.50	5.40	1.90	2.00	7.80	2.60
8	4.20	5.00	13.90	10.00	5.20	13.20	4.30	6.50	1.80	2.00	6.70	2.60
9	4.20	5.00	13.50	9.00	5.90	13.70	4.70	6.90	1.70	1.90	5.50	2.90
10	4.60	5.40	11.70	8.50	6.90	13.10	6.00	7.00	1.50	1.90	4.60	3.20
11	4.70	7.20	11.60	9.00	7.70	12.40	6.60	5.50	1.40	2.00	3.90	3.50
12	5.20	8.90	10.70	9.60	8.00	11.50	7.20	4.60	1.20	2.10	3.70	3.70
13	5.20	15.80	9.30	10.10	9.00	9.40	8.20	4.30	1.10	2.10	3.80	3.80
14	5.40	21.60	8.70	10.90	9.20	7.00	8.30	4.00	1.50	1.90	4.00	3.80
15	5.40	22.80	8.50	11.00	9.80	5.50	7.40	4.10	6.60	1.70	3.90	3.60
16	5.40	24.60	8.50	11.50	11.90	4.40	6.40	4.40	11.80	1.60	3.80	3.50
17	5.20	25.00	8.50	12.00	16.30	3.80	6.30	5.20	12.80	1.90	3.70	3.40
18	4.70	24.10	8.00	12.30	16.70	3.40	6.20	6.80	13.00	2.50	3.60	3.30
19	4.70	22.60	7.50	12.50	15.70	3.20	5.50	8.00	13.40	3.20	3.60	3.10
20	4.40	21.80	7.00	12.00	16.00	3.10	4.10	9.10	15.00	3.90	3.60	3.10
21	4.40	19.70	6.50	10.00	16.70	3.10	3.60	10.00	16.80	4.20	3.50	3.10
22	4.60	16.20	6.50	8.00	16.60	3.00	3.00	10.70	17.00	3.60	3.50	3.30
23	4.60	14.10	6.30	7.60	14.50	3.00	2.50	10.80	15.40	3.00	3.40	3.50
24	4.10	13.90	6.50	7.60	10.00	3.50	2.30	10.70	10.70	2.50	3.30	3.70
25	3.70	12.60	7.00	7.70	6.30	4.10	2.60	10.70	4.80	2.30	3.30	3.70
26	3.50	11.20	7.10	7.30	5.50	3.70	3.00	10.60	4.00	2.10	3.20	5.00
27	3.30	10.60	9.00	6.20	4.90	3.50	3.40	10.60	3.70	2.00	3.30	6.20
28	3.40	9.10	10.00	5.40	4.20	3.60	3.90	7.30	3.40	1.90	3.30	7.10
29	3.60	.....	11.80	5.30	4.40	4.70	3.60	3.30	3.20	1.80	3.30	7.30
30	4.10	.....	14.40	5.20	4.50	6.00	2.80	2.90	2.80	1.80	3.20	6.80
31	4.30	.....	14.80	.....	5.00	.....	2.60	2.60	.....	1.70	.....	6.10

Rating table for Flint River at Albany, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.1	2,610	2.8	4,530	7.5	10,345	15.0	20,400
1.2	2,720	3.0	4,760	8.0	10,970	16.0	21,950
1.3	2,830	3.2	4,995	8.5	11,595	17.0	23,500
1.4	2,940	3.4	5,235	9.0	12,220	18.0	25,050
1.5	3,050	3.6	5,475	9.5	12,845	19.0	26,600
1.6	3,160	3.8	5,720	10.0	13,470	20.0	28,150
1.7	3,270	4.0	5,970	10.5	14,095	21.0	29,700
1.8	3,380	4.5	6,595	11.0	14,720	22.0	31,250
1.9	3,495	5.0	7,220	11.5	15,345	23.0	32,800
2.0	3,610	5.5	7,845	12.0	15,970	24.0	34,350
2.2	3,840	6.0	8,470	12.5	16,650	25.0	35,900
2.4	4,070	6.5	9,095	13.0	17,350		
2.6	4,300	7.0	9,720	14.0	18,850		

Above gage height 13.50 feet the curve becomes a tangent with a difference of 155 per tenth.

Estimated monthly discharge of Flint River at Albany, Ga., for 1903.

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	7,720	4,760	6,305	1.26	1.45
February	35,900	6,595	17,694	3.54	3.69
March	20,090	8,845	13,001	2.60	3.00
April	19,470	7,470	13,510	2.70	3.01
May	23,035	5,595	11,769	2.35	2.71
June	18,385	4,760	8,869	1.77	1.97
July	11,345	3,955	7,076	1.42	1.64
August	14,470	3,725	8,529	1.71	1.97
September	23,500	2,610	8,709	1.74	1.94
October	6,220	3,160	3,976	.80	.92
November	10,720	3,270	5,837	1.17	1.31
December	10,095	4,300	5,789	1.16	1.34
The year	35,900	2,610	9,255	1.85	24.95

KINCHAFOONEE CREEK NEAR ALBANY, GA.

This station was established as a temporary station March 9, 1903, by F. A. Murray. It is located at the wagon bridge 3 miles north of Albany, Ga., 200 feet below the Central of Georgia Railroad bridge and about one-half mile above the mouth of the creek. The gage is a vertical rod fastened to the cypress tree on the left bank 100 feet above the bridge, and reads from 0 to 10 feet. During 1903 it was read once daily by T. M. Nelson. Discharge measurements are made from the single-span highway bridge and its approaches, which cross the river at an angle to the direction of the current. The initial point for soundings is the center of the iron pier on the left bank, downstream side. The channel is curved both above and below the station. Both banks are high and all water passes beneath the bridge and its approaches. The bed is probably somewhat shifting.

Bench mark No. 1 is the top of the crossbeam 30 feet from the initial point for soundings on the upstream side of the bridge. Its elevation is 26.52 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in a rock on the left bank about 25 feet below the bridge. Its elevation is 6.97 feet above the zero of the gage. Bench mark No. 3 is the top of the iron pier on the left bank, upstream side. Its elevation is 26.37 feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Kinchafoonee Creek near Albany, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	F. A. Murray	4.28	3,886
May 22	M. R. Hall	3.32	1,682
July 2	F. A. Murray	1.84	944
September 19	do	3.29	2,051
October 15	M. R. Hall	.98	422
December 22	F. A. Murray	1.76	851

Mean daily gage height, in feet, of Kinchafoonee Creek near Albany, Ga., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.90	1.50	1.90	1.80	1.20	1.00	1.20	0.90	1.60
2		2.90	1.50	1.60	1.80	1.30	1.00	1.10	1.10	1.60
3		2.80	1.50	1.50	1.80	1.30	1.00	1.10	1.50	1.60
4		2.80	1.50	1.80	1.90	1.20	1.00	1.10	2.00	1.60
5		2.80	1.90	2.00	1.70	1.20	1.00	1.10	2.50	1.60
6		2.70	2.60	2.60	1.60	1.20	.90	1.10	2.80	1.60

Mean daily gage height, in feet, of Kinchafoonee Creek, etc.—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7	.....	2.60	2.60	2.90	1.70	1.30	.90	1.00	2.80	1.60
8	.....	2.50	2.70	3.20	1.90	1.50	.90	1.00	2.70	1.60
9	3.20	2.40	2.90	2.80	2.20	1.50	.90	1.00	2.50	1.60
10	3.00	2.40	2.70	2.40	2.60	1.50	.80	1.00	2.30	1.60
11	2.80	2.40	2.70	2.00	2.60	1.50	.80	1.00	2.20	1.60
12	2.60	2.40	2.90	1.90	2.60	1.50	.80	.90	2.10	1.60
13	2.40	2.50	3.10	1.70	2.60	1.60	.80	.90	2.10	1.60
14	2.20	2.60	3.60	1.70	2.70	1.70	1.60	.90	2.10	1.60
15	2.20	3.00	4.60	1.60	2.70	1.80	3.90	.80	2.00	1.60
16	2.20	3.40	8.60	1.50	2.50	1.80	4.30	.80	2.00	1.60
17	2.20	3.60	11.80	1.40	2.10	1.80	4.60	.80	2.00	1.60
18	2.20	3.50	9.30	1.30	1.70	2.40	4.20	.80	2.00	1.60
19	2.20	3.00	6.60	1.30	1.50	2.80	3.30	1.40	2.00	1.60
20	2.20	2.80	5.20	1.30	1.30	3.20	2.90	1.40	2.00	1.60
21	2.30	2.70	4.60	1.30	1.30	3.70	2.70	1.30	2.00	1.60
22	2.30	2.60	3.70	1.20	1.20	3.90	2.50	1.30	2.00	1.60
23	2.30	2.50	2.90	1.20	1.20	2.90	2.10	1.00	1.90	1.60
24	2.40	2.40	2.70	1.40	1.20	2.20	1.50	.90	1.90	1.60
25	2.40	2.20	2.60	1.50	1.20	1.90	1.40	.90	1.80	1.60
26	2.50	2.00	2.30	1.40	1.30	1.70	1.30	.90	1.80	1.60
27	2.50	1.80	2.00	1.50	1.40	1.50	1.30	.90	1.70	1.90
28	2.50	1.70	1.90	1.50	1.50	1.30	1.30	.90	1.60	2.40
29	2.60	1.70	2.00	1.60	1.30	1.10	1.20	.90	1.60	2.60
30	2.70	1.60	2.00	1.80	1.30	1.10	1.20	.90	1.60	2.60
31	2.80	.....	2.00	.....	1.30	1.00	.....	.90	.....	2.60

Rating table for Kinchafoonee Creek near Albany, Ga., from March 9 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	332	2.1	1,070	4.0	2,490	6.6	3,900
.9	381	2.2	1,135	4.2	2,630	6.8	4,000
1.0	432	2.3	1,200	4.4	2,760	7.0	4,100
1.1	485	2.4	1,265	4.6	2,880	7.5	4,350
1.2	539	2.5	1,330	4.8	3,000	8.0	4,600
1.3	594	2.6	1,400	5.0	3,100	8.5	4,850
1.4	650	2.7	1,470	5.2	3,200	9.0	5,100
1.5	707	2.8	1,540	5.4	3,300	9.5	5,350
1.6	765	3.0	1,690	5.6	3,400	10.0	5,600
1.7	824	3.2	1,850	5.8	3,500	11.0	6,100
1.8	884	3.4	2,010	6.0	3,600	12.0	6,600
1.9	945	3.6	2,170	6.2	3,700		
2.0	1,007	3.8	2,330	6.4	3,800		

Rating table not well determined above 3 feet gage height.

Estimated monthly discharge of Kinchafoonee Creek near Albany, Ga., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 9–31	1,850	1,135	1,314
April	2,170	765	1,398
May	6,500	707	1,954
June	1,850	539	874
July	1,470	539	892
August	2,410	432	911
September	2,880	332	934
October	650	332	438
November	1,540	381	1,006
December	1,400	765	848

MUCKALEE CREEK NEAR ALBANY, GA.

This station was established March 9, 1903, as a temporary station, by F. A. Murray. It is located at the wagon bridge 3 miles north of Albany, Ga., and a short distance below the mouth of Kinchafoonee Creek. The gage is a vertical rod of 1 by 4 inch board nailed to a scantling, fastened to a tree on the left bank, just above the bridge, and reads from zero to 14 feet. During 1903 it was read once each day by T. M. Nelson. Discharge measurements are made from the single-span highway bridge and its approaches. The initial point for soundings is the river side of the iron pier on the right bank, downstream side of the bridge. The channel is straight for 300 feet above the station and for 200 feet below. The current is regular and of moderate velocity. Both banks are high and will not overflow. The bed is rocky and probably permanent. The river flows in one channel at all stages. Backwater from the Flint River affects the discharge at high stages.

Bench mark No. 1 is the top of the upstream pier on the right bank; its elevation is 27.65 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in a rock on the right bank about 40 feet below the bridge. Its elevation is 11.91 feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Muckalee Creek near Albany, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	F. A. Murray	6.60	5,141
May	M. R. Hall	7.40	2,829
July 2	F. A. Murray	1.88	1,473
September 19	do	6.22	4,195
October 15	M. R. Hall	.72	644
December 22	F. A. Murray	1.59	1,343

Mean daily gage height, in feet, of Muckalee Creek near Albany, Ga., for 1903.

Day.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.80	1.60	1.90	1.90	1.20	1.10	1.30	1.00	1.60
2		5.00	1.60	1.80	2.00	1.30	1.10	1.30	1.10	1.60
3		4.90	1.60	1.70	1.90	1.30	1.00	1.20	1.50	1.60
4		4.90	1.60	1.90	1.90	1.20	1.00	1.20	2.00	1.60
5		4.90	2.00	2.60	1.70	1.20	1.00	1.20	2.50	1.60
6		4.80	2.70	3.10	1.70	1.30	.90	1.20	2.80	1.60
7		4.40	2.70	3.30	1.60	1.50	.90	1.10	2.80	1.60
8		3.90	2.80	2.90	1.70	1.60	.90	1.10	2.70	1.60
9	4.80	3.00	3.00	2.50	1.90	1.60	.90	1.10	2.50	1.60
10	4.60	2.80	3.20	2.10	2.20	1.60	.80	1.10	2.30	1.60
11	4.40	2.70	3.20	2.00	2.60	1.60	.80	1.00	2.20	1.60
12	4.20	2.70	3.50	1.90	2.60	1.60	.80	1.00	2.10	1.60
13	3.00	3.00	3.90	1.80	2.60	1.60	.80	1.00	2.10	1.60
14	2.80	3.50	4.60	1.80	2.70	1.70	1.60	1.00	2.10	1.60
15	2.80	4.00	5.60	1.70	2.70	1.80	4.10	1.00	2.00	1.60
16	2.80	5.30	8.80	1.50	2.50	1.90	6.50	1.00	2.00	1.60
17	2.80	5.40	12.60	1.50	2.10	2.10	8.60	1.00	2.00	1.60
18	2.80	5.00	11.90	1.50	1.70	2.70	8.00	1.00	2.00	1.60
19	2.80	4.60	7.90	1.40	1.60	3.10	7.10	1.50	2.00	1.60
20	2.80	3.00	7.80	1.40	1.50	3.50	6.00	1.50	2.00	1.60
21	2.90	2.80	7.60	1.40	1.30	3.70	6.00	1.30	2.00	1.60
22	2.90	2.60	7.60	1.40	1.20	4.00	6.00	1.30	2.00	1.60
23	2.90	2.50	6.00	1.30	1.20	3.00	5.20	1.20	1.90	1.60
24	2.90	2.40	4.50	1.50	1.20	2.30	2.60	1.10	1.90	1.60
25	2.90	2.40	3.70	1.60	1.30	2.00	1.50	1.10	1.80	1.60
26	3.00	2.30	2.60	1.50	1.30	1.80	1.50	1.00	1.80	1.60
27	3.00	2.10	2.10	1.60	1.40	1.60	1.50	1.00	1.70	1.90
28	3.00	1.80	2.00	1.60	1.50	1.40	1.50	1.00	1.60	2.40
29	3.20	1.70	2.00	1.60	1.30	1.20	1.40	1.00	1.60	2.60
30	4.40	1.70	1.90	1.80	1.30	1.20	1.40	1.00	1.60	2.60
31	4.60		1.90		1.30	1.20		1.00		2.60

Rating table for Muckalee Creek near Albany, Ga., from March 9 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.7	630	1.8	1,320	2.9	2,090	4.0	2,860
.8	675	1.9	1,390	3.0	2,160	4.1	2,930
.9	720	2.0	1,460	3.1	2,230	4.2	3,000
1.0	770	2.1	1,530	3.2	2,300	4.3	3,070
1.1	830	2.2	1,600	3.3	2,370	4.4	3,140
1.2	900	2.3	1,670	3.4	2,440	4.5	3,210
1.3	970	2.4	1,740	3.5	2,510	4.6	3,280
1.4	1,040	2.5	1,810	3.6	2,580	4.7	3,350
1.5	1,110	2.6	1,880	3.7	2,650	4.8	3,420
1.6	1,180	2.7	1,950	3.8	2,720	4.9	3,490
1.7	1,250	2.8	2,020	3.9	2,790	5.0	3,560

Table not well determined, especially above 5 feet gage height, where backwater from Flint River greatly affects the rating.

Estimated monthly discharge of Muckalee Creek near Albany, Ga., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 9–31	3,420	2,020	2,382
April	3,840	1,250	2,508
May 1–14 and 24–31 [a]			1,928
June	2,370	970	1,357
July	1,950	900	1,311
August	2,860	900	1,388
September 1–15 and 23–30 [a]			1,120
October	1,110	770	850
November	2,020	770	1,451
December	1,880	1,180	1,205

[a] Discharges for missing days not given on account of backwater.

FLINT RIVER NEAR WOODBURY, GA.

Measurements of the flow of Flint River were made during 1897 and 1898 at Molina, Ga., but the river bed was so shifting that the station was discontinued on June 2, 1898. Two measurements were made in 1899 at the Macon and Birmingham Railroad bridge, near Woodbury Ga., 5 miles below the Molina station. On March 29,

1900, a gage was put in near this bridge, and the station was reestablished.

The gage is graduated on a 1 by 5 inch plank in 5-foot sections; the part reading from zero to 10 feet is attached to a willow tree on the left bank about 300 feet above the bridge and about 50 feet below Riggins's old ferry; the section reading from 10 to 15 feet is fastened to a sweet gum tree 50 feet from the left bank and 150 feet upstream from the bridge. This gage was maintained by the Georgia geological survey until November 1, 1900, when it was adopted by the United States Weather Bureau instead of the one at Reynolds, Ga. The observer is J. C. Wright, who is paid by the United States Weather Bureau. Discharge measurements are made from the Macon and Birmingham Railroad bridge and its trestle approaches. This is a two-span iron bridge with the base of its rails 27.5 feet above low water. The initial point for soundings is the end of the iron bridge on the right bank, downstream side. The bridge and its piers are oblique to the direction of the current and the bed is rough and irregular and probably permanent. The channel above and below the station is slightly curved for 800 feet. Both banks are subject to overflow, but all water passes beneath the bridge and its approaches.

Bench mark No. 1 is the top of the downstream end of the second and third crossbeams from the left bank end of the bridge. The elevation of this bench mark is 27 feet above the zero of the gage. Bench mark No. 2 is a cut in the hickory tree on the upstream side of the old ferry landing, 50 feet from the left bank of the river and about 75 feet upstream from the gage. Its elevation is 7 feet above the zero of the gage. Bench mark No. 3 is a copper plug set in solid rock on the west side of the river about 100 feet from the water and 100 feet upstream from a point opposite the gage. Its elevation is 16.24 feet above the zero of the gage. The zero of the gage is at an elevation of 660 feet above sea level.

The observations at the station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Flint River near Woodbury, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 12	M. R. Hall	9.20	16,287
March 26	J. M. Giles	5.45	8,861
April 22	E. C. Murphy	2.45	2,718
Do	do	2.45	2,679
June 29	J. M. Giles	1.48	1,591
July 30	do	.37	503
September 30	M. R. Hall	.28	387

Mean daily gage height, in feet, of Flint River near Woodbury, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.20	1.00	4.70	4.50	1.00	1.20	1.00	0.60	0.10	0.20	0.30	0.30
2	1.10	.90	3.70	3.90	.90	1.50	.90	.70	.20	.20	.40	.30
3	1.00	.90	2.90	3.00	1.00	1.30	2.50	.80	.10	.20	.30	.30
4	1.20	1.00	3.00	2.70	1.10	1.40	1.10	1.00	.00	.20	.40	.40
5	1.10	1.20	4.20	2.30	1.00	2.20	.90	1.50	.20	.20	.50	.40
6	1.00	1.20	3.60	2.00	.90	2.50	.80	2.50	.10	.10	.60	.40
7	.90	1.50	2.90	1.70	2.00	2.90	2.00	1.40	.10	.20	.50	.60
8	.80	13.00	2.40	1.80	1.90	2.80	1.20	1.00	.00	.50	.40	.50
9	.70	11.50	2.20	2.20	1.80	2.40	1.30	.80	.00	.80	.40	.60
10	.60	10.00	2.40	2.10	1.50	2.20	1.00	1.30	.00	.50	.30	.90
11	.60	9.00	3.00	2.30	1.30	1.50	.90	.90	.00	.30	.40	.80
12	.50	9.50	3.10	2.20	1.00	1.20	.80	.50	.00	.30	.40	.70
13	1.50	7.50	2.60	3.10	1.10	.90	1.70	.60	.00	.20	.50	.60
14	1.20	5.70	2.00	2.90	1.30	.60	2.80	.80	.20	.20	.40	.80
15	1.10	3.80	2.10	2.50	4.60	.30	2.40	.90	5.30	.10	.40	.70
16	1.00	2.70	1.90	2.20	6.00	.50	2.00	1.00	5.90	.20	.50	.60
17	.90	7.00	1.80	1.90	4.10	.60	1.60	1.20	4.20	.60	.50	.50
18	.80	6.40	1.70	1.70	2.70	.50	1.00	2.70	2.70	1.10	.80	.50
19	.70	5.40	1.60	1.40	1.80	.50	.60	6.00	1.60	.70	.70	.40
20	.80	3.90	1.50	2.10	1.50	.50	1.00	3.60	1.20	.50	.60	.60
21	.90	2.70	1.40	2.90	1.30	.40	.60	2.00	.80	.40	.50	.90
22	.80	2.00	1.80	2.50	1.20	.50	.40	1.40	.70	.40	.60	.90
23	.70	1.70	5.60	1.90	1.10	.50	.20	1.10	.60	.30	.50	.80
24	.80	1.50	7.50	1.50	1.00	.50	.10	.90	.50	.30	.50	.70
25	.90	1.40	5.80	1.30	.90	.40	.20	.50	.40	.20	.40	.60
26	.90	1.30	5.80	2.20	.80	.50	.80	.40	.40	.30	.50	.50
27	.80	1.40	3.70	2.00	.70	1.90	.60	.20	.30	.20	.40	.40
28	1.40	3.00	2.20	1.50	.60	1.50	.40	.30	.40	.20	.40	.80
29	1.50	.....	2.50	1.20	.80	1.60	.30	.20	.30	.30	.40	.70
30	1.30	.....	4.50	1.10	.90	1.30	.20	.10	.30	.30	.40	.70
31	1.10	.....	4.90	.....	.80	.....	.50	.30	.....	.20	.....	.60

Rating table for Flint River near Woodbury, Ga., for 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	290	2.6	2,890	5.2	6,880	7.8	12,750
.2	360	2.8	3,150	5.4	7,260	8.0	13,250
.4	470	3.0	3,410	5.6	7,640	8.2	13,750
.6	620	3.2	3,680	5.8	8,040	8.4	14,250
.8	800	3.4	3,960	6.0	8,450	8.6	14,750
1.0	1,005	3.6	4,240	6.2	8,880	8.8	15,250
1.2	1,225	3.8	4,540	6.4	9,320	9.0	15,750
1.4	1,455	4.0	4,840	6.6	9,780	9.2	16,250
1.6	1,685	4.2	5,160	6.8	10,260	9.4	16,750
1.8	1,920	4.4	5,480	7.0	10,750	9.6	17,250
2.0	2,160	4.6	5,820	7.2	11,250	9.8	17,750
2.2	2,400	4.8	6,160	7.4	11,750	10.0	18,250
2.4	2,640	5.0	6,520	7.6	12,250	11.0	21,250

Table same as that for 1902.

Estimated monthly discharge of Flint River near Woodbury, Ga., for 1903.

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,570	540	977	0.99	1.14
February	25,750	900	6,508	6.59	6.86
March	12,000	1,455	3,915	3.96	4.57
April	5,650	1,115	2,460	2.49	2.78
May	8,450	620	1,755	1.78	2.05
June	3,280	410	1,315	1.33	1.48
July	3,150	320	1,107	1.12	1.29
August	8,450	320	1,363	1.38	1.59
September	8,240	290	1,203	1.22	1.36
October	1,115	320	451	.46	.53
November	800	410	985	1.00	1.12
December	900	410	629	.64	.74
The year	25,750	290	1,889	1.91	25.51

CHATTAHOOCHEE RIVER AT WEST POINT, GA.

This station was established July 30, 1896, by M. R. Hall, and is now maintained by the United States Weather Bureau. It is located at Montgomery street wagon bridge. The boxed chain gage is securely bolted to the outside of the iron railing of the downstream footway at a point 122 to 124 feet from the initial point for soundings. The boxed gage is so constructed that the length of the chain is always 2 feet greater than the elevation of the bottom of the box above gage datum. The length of the chain is 29.26 feet from the end of the weight to the marker. The wagon bridge from which discharge measurements are made is in three spans, with short approaches from each end. The floor of the bridge is about 24 feet above low water. The initial point for soundings is the end of the hand rail on the right bank, downstream side of the bridge. The channel is straight for about 2,000 feet above and 3,000 feet below the station. The current has a fair velocity, except at low stages. The right bank is high and overflows only at high water, when most of the town is covered. The left bank is somewhat lower and overflows for about 800 feet at a gage height of 20 feet. The bed of the stream is of sand and gravel and is unstable.

Bench mark No. 1 is the top of the downstream end of the second iron crossbeam under the bridge floor from the right-bank end of the

highway bridge. Its elevation is 24.19 feet above gage datum. Bench mark No. 2 is the top of the thirty-eighth milepost on the Franklin and West Point survey of the United States engineers. This post is a cast-iron cap 6 inches square, set in concrete, and approximately on a level with the ground. It is marked "U. S. 38." A raised point in the center of the cap is the bench mark; its elevation is 15.68 feet above gage datum. The location of this post is on the right bank of the river, 340 feet upstream from the wagon bridge and 50 feet from the edge of the river. It is 60 feet south of the Episcopal Church, and is 132 feet east of the northeast corner of a lot belonging to W. G. Sheafers, which is the southwest corner of Jasper and Front streets. Bench mark No. 3 is the top of the first marble block and bottom of the second marble block of the Confederate monument in the center of the street, 1,300 feet from the initial point of soundings and 860 feet from the east end of the bridge. Its elevation is 25.56 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Chattahoochee River at West Point, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 6	M. R. Hall	3.95	5,056
April 22	E. C. Murphy and M. R. Hall.	5.39	8,713
Do	E. C. Murphy	5.38	8,610
June 5	M. R. Hall	9.70	20,957
June 6	do	11.30	25,622
July 30	J. M. Giles	3.46	4,761
July 31	do	4.07	5,993
September 23	M. R. Hall	2.40	2,451
September 24	do	2.32	2,416
December 17	W. E. Hall	2.37	2,460

Mean daily gage height, in feet, of Chattahoochee River at West Point, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.10	3.70	11.60	12.20	4.40	5.70	4.00	3.80	2.20	2.10	2.00	2.20
2	.....	3.40	11.20	10.20	4.40	6.70	3.70	3.00	2.20	2.10	2.10	2.20
3	4.10	3.30	11.30	7.00	4.40	6.10	3.50	3.70	2.20	2.00	2.20	2.20
4	4.10	3.60	7.40	6.40	4.40	8.80	3.60	3.80	2.10	2.00	2.50	2.20
5	4.10	6.40	7.00	6.10	4.40	9.30	4.10	4.60	2.10	2.00	3.50	2.20
6	4.00	6.90	6.40	5.70	4.30	10.80	3.80	4.50	2.10	2.00	2.80	2.30
7	3.80	6.20	6.10	5.50	5.40	11.90	4.00	4.00	2.30	2.00	2.60	2.30
8	3.60	18.50	5.70	5.40	5.20	11.40	4.00	3.30	2.10	2.00	2.80	2.30

Mean daily gage height, in feet, of Chattahoochee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9	3.40	20.10	5.30	9.20	4.80	6.70	4.30	2.90	2.10	2.50	2.50	2.40
10	3.30	13.90	6.10	8.00	4.50	6.10	4.00	2.80	2.00	2.20	2.30	2.50
11	3.30	12.00	7.60	6.80	4.30	5.10	3.70	2.80	2.00	2.10	2.30	2.50
12	4.10	14.90	9.20	5.70	4.20	6.10	3.70	2.70	2.20	2.10	2.30	2.40
13	4.20	12.80	10.20	6.20	6.60	5.10	3.60	2.90	2.00	2.00	2.50	2.40
14	5.20	10.10	8.70	6.90	5.90	4.60	6.40	3.00	2.00	2.00	2.50	2.40
15	4.20	6.40	6.30	8.20	12.70	4.20	6.10	2.80	3.50	2.00	2.40	2.40
16	3.80	5.50	5.90	10.10	9.00	4.00	4.50	4.00	4.70	2.00	2.40	2.40
17	3.60	14.50	5.60	6.30	6.10	3.90	3.70	4.30	5.30	2.50	2.30	2.40
18	3.50	15.90	5.30	5.60	4.80	3.80	3.40	4.70	4.50	2.50	2.70	2.30
19	3.30	14.60	5.00	5.30	4.40	3.70	3.20	5.70	3.40	2.40	2.90	2.30
20	3.20	14.20	4.90	7.20	4.20	3.60	3.10	5.10	3.00	2.30	2.70	2.30
21	3.20	6.30	5.70	7.20	4.10	3.60	3.00	3.80	2.60	2.30	2.60	2.60
22	3.20	5.50	8.20	5.70	4.00	3.80	2.90	3.10	2.50	2.20	2.50	2.60
23	3.10	5.10	13.10	5.10	3.90	3.60	2.90	2.90	2.40	2.10	2.40	2.60
24	3.10	4.90	14.70	4.90	3.80	3.60	2.90	2.70	2.40	2.00	2.30	2.60
25	3.20	4.60	14.60	4.70	3.70	3.50	3.10	2.60	2.30	2.00	2.30	2.50
26	3.20	4.50	15.20	5.10	3.60	4.00	3.00	2.50	2.30	2.00	2.30	3.00
27	3.20	4.40	14.30	5.00	3.60	4.50	2.80	2.40	2.20	2.00	2.30	3.00
28	3.50	8.30	6.40	4.90	3.60	5.00	2.70	2.30	2.10	2.00	2.30	2.80
29	3.70	.....	7.00	4.60	3.60	5.20	2.70	2.30	2.10	2.00	2.20	2.70
30	3.50	.....	12.00	4.50	3.60	4.70	3.00	2.30	2.10	2.00	2.20	2.50
31	3.90	.....	13.50	.....	5.50	.....	4.00	2.30	.....	2.00	.....	2.40

Rating table for Chattahoochee River at West Point, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	935	2.3	2,240	4.2	5,880	9.5	20,750
1.1	970	2.4	2,380	4.4	6,400	10.0	22,200
1.2	1,000	2.5	2,530	4.6	6,940	10.5	23,650
1.3	1,090	2.6	2,680	4.8	7,490	11.0	25,100
1.4	1,180	2.7	2,840	5.0	8,040	12.0	28,800
1.5	1,280	2.8	3,000	5.5	9,420	13.0	33,410
1.6	1,380	2.9	3,170	6.0	10,800	14.0	38,030
1.7	1,540	3.0	3,340	6.5	12,177	15.0	42,630
1.8	1,600	3.2	3,700	7.0	13,560	16.0	47,230
1.9	1,720	3.4	4,080	7.5	14,954	17.0	51,830
2.0	1,840	3.6	4,480	8.0	16,400	18.0	56,430
2.1	1,970	3.8	4,920	8.5	17,850		
2.2	2,100	4.0	5,370	9.0	19,300		

Table same as that for 1898.

Estimated monthly discharge of Chattahoochee River at West Point, Ga., for 1903.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	8,592	3,520	4,708	1.43	1.65
February	66,090	3,890	21,593	6.54	6.81
March	43,550	7,765	19,626	5.95	6.86
April	29,720	6,670	12,345	3.74	4.17
May	32,030	4,480	7,896	2.39	2.76
June	28,340	4,280	9,976	3.02	3.37
July	11,904	2,840	4,782	1.45	1.67
August	9,972	2,240	4,203	1.27	1.46
September	8,868	1,840	2,825	.86	.96
October	2,530	1,840	1,988	.60	.69
November	4,280	1,840	2,485	.75	.84
December	3,340	2,100	2,463	.75	.86
The year	66,090	1,840	7,908	2.40	32.10

CHATTAHOOCHEE RIVER AT OAKDALE, GA.

This station was established at Oakdale by Cyrus C. Babb on October 17, 1895. It is located at the Southern Railway bridge, 1 mile above the mouth of Proctor Creek, 2 miles below the mouth of Peachtree Creek, one-fourth mile west of Chattahoochee, 1 mile east of Oakdale, and 8 miles northwest of Atlanta.

On July 30, 1896, the location of the station was changed to Mason & Turner's ferry, 1 mile below Oakdale. The gage at this point, known as the "Oakdale lower gage," is nailed to a tree on the right bank 100 feet below the ferry and set 1 foot lower than the gage at the Southern Railway bridge. On June 1, 1899, the lower gage was discontinued and the upper gage resumed and adopted by the United States Weather Bureau, the United States Geological Survey still receiving the records and making the current-meter discharge measurements at this point. The gage now used is in two sections, the first, reading from zero to 8 feet, fastened to a willow tree 100 feet above the bridge on the left bank; the second, reading from 8 to 26 feet, fastened to an ash tree 30 feet above the bridge on the left bank. It is set on the same datum as the old wire gage of the United States Geological Survey established at that point by Mr. Babb in 1895 and above referred to. Its zero point is 753.5 feet above sea level. Discharge measurements are made from the railway bridge. The initial point for soundings is the end of the iron bridge on the right bank, upstream side.

Bench mark No. 1 is a railroad spike in the corner of the pier on the right bank 12.39 feet above datum of gage. Bench mark No. 2 is a large bridge spike, in a sycamore tree about 50 feet above the bridge on the left bank; it is at an elevation of 11 feet above the zero of the gage. Bench mark No. 3, determined by measuring down to the water, is the top of the iron girder, 40 feet from the initial point for soundings, on the upstream side of the bridge. Its elevation is 57.55 feet above the zero of the gage. The flow is obstructed by rafts, which have to be cleared from the channel occasionally. The channel is straight and the current swift. The banks are subject to overflow. The bed of the stream is constant and the results are fairly good, except at high stages, when the water flows through the trestlework. The observer is J. B. Austin.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Chattahoochee River at Oakdale, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 2	M. R. Hall	9.95	9,787
March 23	J. M. Giles	21.85	33,617
April 23	E. C. Murphy	5.03	4,836
June 2	J. M. Giles	12.20	12,481
September 2	do	1.25	1,612
October 7	do	1.10	1,359
November 5	do	1.90	1,882

Mean daily gage height, in feet, of Chattahoochee River at Oakdale, Ga., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Nov.	Dec.
1	2.60	3.00	19.40	1.00	1.00	17	2.50	24.00	5.90	1.30	1.30
2	2.80	2.90	12.00	.....	1.00	18	2.40	25.60	4.80	1.70	1.30
3	3.10	3.40	7.20	1.50	1.00	19	2.20	9.40	4.60	1.50	1.30
4	2.80	7.60	6.60	2.00	1.00	20	2.10	4.90	5.00	1.50	1.50
5	2.50	10.20	5.80	2.00	1.00	21	2.00	2.70	11.40	1.50	1.60
6	2.40	6.70	6.40	3.00	1.00	22	2.00	3.00	13.00	1.30	1.60
7	2.60	7.70	5.80	2.00	1.00	23	1.90	3.20	21.00	1.30	1.50
8	2.80	18.00	5.80	1.50	1.00	24	2.20	3.70	23.40	1.20	1.50
9	2.70	15.60	5.50	1.50	1.00	25	2.50	4.10	22.40	1.10	1.50
10	2.50	7.80	7.40	1.30	1.20	26	2.40	3.70	8.80	1.20	1.70
11	3.30	11.00	12.40	1.30	1.20	27	2.00	4.20	7.50	1.00	1.70
12	4.00	16.00	15.00	1.50	1.00	28	2.80	11.40	6.80	1.00	1.50
13	4.90	10.60	11.40	1.40	1.30	29	2.70	.....	10.80	1.00	1.50
14	3.80	4.70	7.70	1.30	1.50	30	4.50	.....	16.60	1.00	1.40
15	3.20	5.80	6.80	1.20	1.50	31	3.40	.....	15.80	.....	1.30
16	2.80	5.80	6.00	1.20	1.30						

[a] Gage heights from April 1 to October 31 not reliable.

Rating table for Chattahoochee River at Oakdale, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	1,300	4.8	4,440	8.6	8,500	16.0	17,940
1.2	1,420	5.0	4,640	8.8	8,720	16.5	18,650
1.4	1,545	5.2	4,840	9.0	8,940	17.0	19,400
1.6	1,675	5.4	5,040	9.2	9,180	17.5	20,160
1.8	1,810	5.6	5,240	9.4	9,420	18.0	20,960
2.0	1,950	5.8	5,440	9.6	9,660	18.5	21,800
2.2	2,095	6.0	5,640	9.8	9,900	19.0	22,800
2.4	2,245	6.2	5,860	10.0	10,140	19.5	23,800
2.6	2,400	6.4	6,080	10.5	10,740	20.0	25,000
2.8	2,560	6.6	6,300	11.0	11,340	20.5	26,300
3.0	2,730	6.8	6,520	11.5	11,940	21.0	27,800
3.2	2,900	7.0	6,740	12.0	12,540	21.5	29,550
3.4	3,080	7.2	6,960	12.5	13,190	22.0	31,300
3.6	3,260	7.4	7,180	13.0	13,840	22.5	33,050
3.8	3,450	7.6	7,400	13.5	14,490	23.0	34,800
4.0	3,640	7.8	7,620	14.0	15,140	23.5	36,550
4.2	3,840	8.0	7,840	14.5	15,840	24.0	38,300
4.4	4,040	8.2	8,060	15.0	16,540	25.0	41,800
4.6	4,240	8.4	8,280	15.5	17,240		

Above 21 feet gage height the curve becomes a tangent with difference of 350 per tenth.

Estimated monthly discharge of Chattahoochee River at Oakdale, Ga., for 1903.[a]

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,540	1,880	2,570	1.65	1.90
February	43,900	2,480	9,710	6.22	6.48
March	36,200	4,240	11,501	7.37	8.51
November	2,730	1,300	1,567	1.00	1.12
December	1,740	1,300	1,483	.95	1.10

[a] Gage heights from Apr. 1 to Oct. 31 discarded because they were unreliable.

CHATTAHOOCHEE RIVER NEAR NORCROSS, GA.

This station was established June 10, 1902, by M. R. Hall. It is located at Medlock's toll bridge, about 4½ miles north of Norcross,

Ga. This point is above the mouth of Johns Creek and below the mouth of Sewannee Creek. A vertical section of gage, reading from zero to 8 feet, is attached to an oak tree on the right bank of the river, 100 feet above the bridge. A chain gage was established March 14, 1903. The center of the pulley is 28.32 feet above the zero of the gage, and the length of the chain from the end of the weight to the marker is 28.75 feet. The gage is read once each day by W. O. Medlock, the bridge keeper. Discharge measurements are made from the downstream side of the single-span bridge and its approaches. The initial point for soundings is 50 feet to right of the center of the downstream tubular pier on the right bank. The channel is slightly curved for 600 feet above and 700 feet below this station. The current is sluggish at low stages. The right bank is high and will overflow only for 50 feet from the water's edge; the left bank will overflow for about 800 feet at a gage height of from 16 to 18 feet. The bed of the stream is sandy and probably changes.

Bench mark No. 1 is the top of the iron pier on the right bank, dowstream side. Its elevation is 27 feet above gage datum. Bench mark No. 2 is a copper plug set in a stone post set flush with the surface of the ground at the side of the road just outside of the toll bridge on the right bank. The post is on line with the downstream side of the bridge and is 145 feet from the center of the pier at the right-bank end of the bridge. Its elevation is 26.92 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Chattahoochee River near Norcross, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 9	M. R. Hall	2.70	1,837
March 14	do	5.35	4,940
May 5	do	4.08	3,543
May 29	J. M. Giles	3.15	2,378
June 26	do	3.13	2,447
July 17	M. R. Hall	3.06	2,254
Do	do	3.06	2,255
August 19	do	3.15	2,337
Do	do	3.05	2,288
Do	F. A. Murray	3.15	2,281
Do	do	3.05	2,203
September 26	do	2.06	1,197
October 23	do	1.94	1,078
November 25	do	1.95	1,062
Do	do	1.95	1,071

Mean daily gage height, in feet, of Chattahoochee River near Norcross, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.90	14.10	7.00	4.00	4.50	3.20	3.10	2.10	2.00	1.90	1.90
2	.....	2.80	7.00	6.00	4.00	9.70	3.10	2.60	2.00	2.00	2.00	1.90
3	.....	3.20	5.60	5.50	4.00	7.50	3.30	6.10	2.60	2.00	2.70	1.90
4	.....	5.20	5.00	5.40	4.20	4.90	3.20	3.60	2.00	2.60	2.30	1.90
5	.....	8.80	4.70	5.10	4.10	9.70	3.10	3.20	2.20	2.00	2.40	1.90
6	.....	4.90	4.80	4.80	3.90	11.20	3.00	2.80	2.10	2.00	2.70	1.90
7	.....	4.30	4.60	4.70	3.80	7.80	3.50	2.60	2.00	2.00	2.20	1.90
8	.....	10.60	4.80	5.80	3.80	5.50	3.10	2.50	2.00	2.00	2.10	1.90
9	2.70	8.60	5.30	7.90	3.80	4.70	3.30	2.40	2.30	2.20	2.00	1.90
10	2.60	5.20	5.00	5.40	3.70	4.40	2.90	2.40	2.20	2.20	2.00	2.00
11	2.70	6.40	8.70	5.00	3.60	5.10	3.20	2.40	2.10	2.00	2.00	1.90
12	5.80	11.10	11.50	4.80	3.60	4.90	3.30	2.70	2.00	2.00	2.10	1.90
13	4.20	6.20	6.40	4.70	3.70	4.10	6.80	2.50	2.00	1.90	2.00	2.00
14	3.40	4.90	5.50	12.60	3.80	3.90	4.60	2.50	1.90	1.90	2.00	2.10
15	3.20	4.80	5.10	7.80	3.90	3.70	3.60	3.20	3.60	1.90	2.00	2.20
16	3.00	4.50	4.80	5.90	3.70	3.60	3.20	3.20	4.90	1.90	2.00	2.00
17	2.90	14.90	4.60	5.40	3.60	3.50	3.00	4.30	3.60	2.00	2.00	1.90
18	2.80	13.70	4.50	5.10	3.50	3.50	3.00	5.00	2.80	2.20	2.30	1.90
19	2.70	5.90	4.30	4.90	3.40	3.50	2.90	3.50	2.40	2.20	2.50	1.90
20	2.60	5.10	4.20	4.80	3.40	3.40	2.80	2.70	2.30	2.00	2.10	1.90
21	2.60	4.70	5.90	4.90	3.40	3.30	2.80	2.60	2.20	2.00	2.00	2.20
22	2.70	4.40	8.00	4.60	3.40	3.30	2.70	2.50	2.20	2.00	2.00	2.30
23	2.60	4.20	16.70	4.50	3.30	3.20	2.70	2.40	2.10	1.90	2.00	2.10
24	2.50	4.00	19.40	4.40	3.20	3.20	2.60	2.30	2.10	1.90	2.00	2.00
25	2.70	3.90	9.00	4.30	3.20	3.10	2.60	2.30	2.10	1.90	2.00	2.00
26	2.70	3.80	6.40	4.40	3.10	3.10	2.50	2.20	2.10	1.90	2.00	2.20
27	2.60	3.70	5.80	4.40	3.10	4.00	2.50	2.20	2.10	1.90	1.90	2.20
28	2.70	3.60	5.50	4.20	3.10	3.80	2.50	2.10	2.10	1.90	1.90	2.00
29	3.60	.....	5.40	4.10	3.10	3.70	2.50	2.10	2.00	1.90	1.90	2.00
30	4.00	.....	10.00	4.00	3.50	3.50	2.50	2.10	2.00	1.90	1.90	2.00
31	3.20	.....	11.40	.....	5.20	.....	2.60	2.30	.....	1.90	.....	1.90

Rating table for Chattahoochee River near Norcross, Ga., from January 9 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.9	1,015	2.9	2,080	3.9	3,205	4.9	4,425
2.0	1,120	3.0	2,190	4.0	3,320	5.0	4,555
2.1	1,225	3.1	2,300	4.1	3,440	5.1	4,685
2.2	1,330	3.2	2,410	4.2	3,560	5.2	4,815
2.3	1,435	3.3	2,520	4.3	3,680	5.3	4,945
2.4	1,540	3.4	2,630	4.4	3,800	5.4	5,075
2.5	1,645	3.5	2,745	4.5	3,920	5.5	5,210
2.6	1,750	3.6	2,860	4.6	4,045	5.6	5,345
2.7	1,860	3.7	2,975	4.7	4,170	5.8	5,615
2.8	1,970	3.8	3,090	4.8	4,295	6.0	5,885

No measurements have been made above gage height 5.35.

Estimated monthly discharge of Chattahoochee River near Norcross, Ga., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January 9–31, 23 days	5,615	1,645	2,281
February, 19 days [a]		1,970	
March, 19 days [a]		3,560	
April, 26 days [a]		3,320	
May	4,815	2,300	2,923
June, 25 days [a]		2,300	
July	7,005	1,645	2,343
August	6,020	1,225	2,055
September	4,425	1,015	1,466
October	1,330	1,015	1,103
November	1,860	1,015	1,222
December	1,435	1,015	1,110

[a] Higher discharges omitted because of lack of high-discharge measurements. Maximum and mean for February, March, April, and June not known.

CHATTAHOOCHEE RIVER NEAR GAINESVILLE, GA.

This station was established on June 26, 1901, 3½ miles northwest of Gainesville, at Thompson's bridge. The gage as originally established was a 15-foot vertical rod, graduated to feet and tenths. It was on the right bank about 50 feet below the bridge.

A standard chain gage is attached to a beam on the upstream side of the bridge about 160 feet from the initial point for soundings. The length of the chain from the end of the chain to the marker is 34.68 feet. During 1903 the observer was Jack Elrod. The bridge from which discharge measurements are made is a three-span wooden structure supported on stone piers. At low water nearly the whole of the river flows through the center span, which is 100 feet long. It is entirely housed in, but holes are cut in the floor along the upstream side at intervals of 12 feet, through which the meter can be lowered for gaging.

The initial point for soundings is the end of the bridge on the left-bank upstream side. The channel is slightly curved for 1,000 feet above and below the station. The bed is of sand and is very changeable.

Bench mark No. 1 is the top of the downstream wooden stringer supporting the bridge floor, about 2 feet to the left of the first stone pier on the left bank. Its elevation is 31 feet above gage datum. Bench mark No. 2 is the first plank of the bridge floor on the right-bank downstream side. Its elevation is 28.70 feet above gage datum. Bench mark No. 3 is a cut on a rock on the south side of the road

about 40 feet from the end of the road on the right bank. It elevation is 31 feet above gage datum. Bench mark No. 4 is a copper plug set in solid rock on the hill about 50 feet from the river and 115 feet downstream from the bridge on the right bank. Its elevation is 42.73 feet above gage datum. Bench mark No. 5 consists of five large nails in a walnut tree on the north side of the road, 175 feet from the left-bank end of the bridge and about 6 feet above ground. These nails are at an elevation of 29.58 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Chattahoochee River near Gainesville, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 10	M. R. Hall	3.09	958
March 28	J. M. Giles	5.43	2,670
April 24	M. R. Hall	4.80	2,248
Do	E. C. Murphy	5.10	2,195
May 4	M. R. Hall	4.87	2,234
June 25	J. M. Giles	3.40	1,519
August 1	F. A. Murray	3.16	1,052
August 29	do	2.52	677
September 25	do	2.43	728
December 9	M. R. and W. E. Hall	2.22	531

Mean daily gage height, in feet, of Chattahoochee River near Gainesville, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.50	3.50	8.00	6.10	4.60	7.00	3.60	3.00	2.60	2.40	2.20	2.20
2	3.40	3.70	6.00	5.70	4.50	13.20	3.60	3.10	2.60	2.30	2.30	2.10
3	3.70	4.40	4.60	5.50	4.70	9.00	3.50	3.20	2.60	2.30	2.50	2.10
4	4.20	7.40	4.20	5.40	4.80	6.50	3.50	3.20	2.60	2.30	2.60	2.10
5	3.90	6.00	4.00	5.30	4.40	10.60	3.50	3.10	2.60	2.30	2.70	2.10
6	3.60	4.50	5.10	5.10	4.20	6.20	3.80	3.10	2.60	2.30	2.70	2.20
7	3.40	4.90	4.70	5.00	4.20	5.90	3.40	3.00	2.60	2.30	2.60	2.20
8	3.40	11.20	5.70	8.60	4.20	5.80	3.40	3.00	2.60	2.60	2.30	2.20
9	3.20	6.40	5.40	5.70	4.20	5.40	3.40	2.90	2.60	2.40	2.30	2.20
10	3.10	5.30	6.00	5.50	4.10	5.10	3.40	2.80	2.60	2.40	2.30	2.20
11	6.00	12.10	12.90	5.40	4.00	5.00	3.70	4.10	2.60	2.30	2.30	2.20
12	5.40	8.70	7.00	5.10	3.90	4.30	6.30	2.90	2.60	2.20	2.40	2.20
13	4.10	5.40	6.00	15.80	4.00	4.00	4.50	3.20	2.60	2.20	2.40	2.50
14	3.70	5.00	5.10	9.70	4.30	4.00	3.70	3.30	2.60	2.20	2.40	2.60
15	3.60	4.20	5.00	6.60	4.10	3.90	3.50	4.10	6.00	2.20	2.30	2.30
16	3.50	9.90	4.90	5.80	4.00	3.90	3.40	7.50	4.70	2.20	2.20	2.20
17	3.50	15.60	4.70	5.50	4.00	3.80	3.40	5.80	3.90	2.20	2.40	2.20
18	3.40	7.10	4.50	5.30	4.00	3.80	3.20	5.00	3.10	2.20	3.10	2.20

Mean daily gage height, in feet, of Chattahoochee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	3.30	5.40	4.40	5.50	4.00	3.80	3.10	3.50	2.80	2.20	2.80	2.20
20	3.30	5.00	4.10	5.40	3.90	3.80	3.10	5.00	2.60	2.20	2.30	2.60
21	3.20	4.70	7.70	5.10	3.90	3.70	3.10	3.20	2.60	2.20	2.30	2.60
22	3.20	4.50	10.50	5.00	3.80	3.70	3.10	3.00	2.60	2.20	2.30	2.50
23	3.20	4.20	25.20	4.80	3.80	3.60	3.00	2.90	2.60	2.10	2.30	2.30
24	3.20	4.00	9.40	4.80	3.80	3.60	3.00	2.80	2.60	2.10	2.30	2.30
25	3.10	3.80	7.00	4.80	3.70	3.50	3.00	2.80	2.50	2.10	2.20	2.40
26	3.10	3.80	6.30	4.80	3.70	3.70	3.00	2.70	2.50	2.10	2.20	2.40
27	3.10	5.60	5.90	4.70	3.70	4.50	2.90	2.70	2.50	2.10	2.20	2.30
28	3.70	14.50	5.50	4.70	3.60	4.00	2.90	2.60	2.40	2.10	2.20	2.30
29	5.50	.....	6.90	4.60	3.60	3.80	2.90	2.60	2.40	2.10	2.20	2.30
30	4.00	.....	12.20	4.60	3.70	3.70	2.90	2.60	2.40	2.10	2.20	2.30
31	3.70	.....	8.20	.....	5.40	.....	3.20	2.60	.....	2.10	.....	2.30

Rating table for Chattahoochee River near Gainesville, Ga., for 1901, 1902, and 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	350	5.6	2,690	9.2	5,030	14.0	8,150
2.2	480	5.8	2,820	9.4	5,160	15.0	8,800
2.4	610	6.0	2,950	9.6	5,290	16.0	9,450
2.6	740	6.2	3,080	9.8	5,420	17.0	10,100
2.8	870	6.4	3,210	10.0	5,550	18.0	10,750
3.0	1,000	6.6	3,340	10.2	5,680	19.0	11,400
3.2	1,130	6.8	3,470	10.4	5,810	20.0	12,050
3.4	1,260	7.0	3,600	10.6	5,940	21.0	12,700
3.6	1,390	7.2	3,730	10.8	6,070	22.0	13,350
3.8	1,520	7.4	3,860	11.0	6,200	23.0	14,000
4.0	1,650	7.6	3,990	11.2	6,330	24.0	14,650
4.2	1,780	7.8	4,120	11.4	6,460	25.0	15,300
4.4	1,910	8.0	4,250	11.6	6,590	26.0	15,950
4.6	2,040	8.2	4,380	11.8	6,720	27.0	16,600
4.8	2,170	8.4	4,510	12.0	6,850	28.0	17,250
5.0	2,300	8.6	4,640	12.5	7,175	29.0	17,900
5.2	2,430	8.8	4,770	13.0	7,500	30.0	18,550
5.4	2,560	9.0	4,900	13.5	7,825	31.0	19,200

Estimated monthly discharge of Chattahoochee River near Gainesville, Ga., for 1903.

[Drainage area, 544 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,950	1,065	1,442	2.65	3.06
February	9,190	1,325	3,247	5.97	6.22
March	15,430	1,650	3,602	6.62	7.63
April	9,320	2,040	2,861	5.26	5.87
May	2,560	1,390	1,709	3.14	3.62
June	7,630	1,325	2,361	4.34	4.84
July	3,145	935	1,273	2.34	2.70
August	3,925	740	1,258	2.31	2.66
September	2,950	610	883	1.62	1.81
October	740	415	497	.91	1.05
November	1,065	480	599	1.10	1.23
December	740	415	535	.98	1.13
The year	15,430	415	1,689	3.10	41.82

MISCELLANEOUS MEASUREMENTS IN APALACHICOLA RIVER DRAINAGE BASIN.

Chattahoochee River.—This stream was measured at Bull Sluice, near Roswell (Morgan Falls post-office), Ga. The gage was maintained by the engineers in charge of construction of the dam.

Discharge measurements of Chattahoochee River at Bull Sluice, near Roswell (Morgan Falls post-office), Ga.

Date.	Gage height.	Discharge.
	Feet.	*Second-feet.*
January 8	13.90	5,979
July 21	11.25	2,427
October 22	10.36	1,359
November 23	10.40	1,284

Little River.—This stream was measured below Dunlap's mill, near Gainesville, Ga.

Discharge measurements of Little River below Dunlap's mill, near Gainesville, Ga., 1903.

Date.	Gage height.	Discharge.
	Feet.	*Second-feet.*
August 29	2.52	83
September 25	2.40	82

Nickajack Creek.—At Oakdale, Ga., this stream was discharging 22 second-feet on September 22, 1903. Oakdale gage, 1.25 feet.

Snake Creek.—Near Banning, Ga., this stream was discharging 27 second-feet on October 27, 1903.

Chestatee River.—Near Dahlonega, Ga., this stream was discharging 1,284 second-feet on October 29, 1903.

Peachtree Creek.—Near Clarkston, Ga., this stream was discharging 4.6 second-feet on December 21, 1903.

Kinchafoonee Creek.—At highway bridge 1 mile west of Leesburg, Ga., this stream was discharging 635 second-feet on December 24, 1903, when the water surface was 19.39 feet below top of iron pier on right bank, downstream side of bridge.

Muckalee Creek.—At wagon bridge 2 miles east of Leesburg, Ga., this stream was discharging 522 second-feet on December 24, 1903, when the water surface was 12.29 feet below top of center pier, upstream side of bridge.

MOBILE RIVER DRAINAGE BASIN.

This is the largest drainage basin in Georgia and Alabama, and is designated the Mobile basin because its waters all enter the Gulf through Mobile River at Mobile, Ala. It is formed as follows: Beginning at the headwaters, Cartecay and Ellijay rivers unite at Ellijay, Ga., to form Coosawattee River. Just above Resaca, Ga., this unites with the Conasauga to form Oostanaula River. At Rome, Ga., the Oostanaula and the Etowah unite to form Coosa River. Six miles above Montgomery, Ala., the Coosa and the Tallapoosa unite to form Alabama River; and not far from the coast the Tombigbee unites with the Alabama to form Mobile River, which flows into Mobile Bay, an arm of the Gulf of Mexico.

Cahaba River is the principal tributary of the Alabama and joins it about 10 miles below Selma. Hillabee Creek flows into Tallapoosa River just above Sturdevant and near Alexander. Talladega Creek is a tributary of the Coosa.

Tombigbee River rises in the northeastern part of Mississippi and enters Alabama in Pickens County. Its principal tributary is the Black Warrior, which is formed by the junction of Mulberry Fork and Sipsey Fork. Locust Fork enters the Black Warrior some distance below the junction. During 1903 the following stations were maintained in this basin under the supervision of M. R. Hall: On the

Cahaba at Centerville, Ala.; on the Alabama at Selma and at Montgomery, Ala.; on Choccolocco Creek near Jenifer, Ala.; on the Tallapoosa at Milstead and at Sturdevant, Ala.; on Hillabee Creek near Alexander, Ala.; on Talladega Creek at Nottingham, Ala.; on the Coosa at Riverside, Ala.; on the Black Warrior at Tuscaloosa and near Cordova, Ala.; on the Black Warrior (Locust Fork) at Palos, Ala.; on the Coosa and Etowah at Rome, Ga.; on the Etowah at Canton, Ga.; on the Coosawattee at Carters, Ga.; on the Tombigbee at Columbus, Miss.

CAHABA RIVER AT CENTERVILLE, ALA.

The station was established on August 7, 1901, and is situated at the iron highway bridge one-fourth mile west of Centerville, Ala., one-half mile above the Mobile and Ohio Railroad bridge. The bridge is a single span supported by tubular iron piers.

The chain gage is fastened to the timber fencing along the downstream side of the bridge. The pulley is 100 feet from the initial point, which is the end of the iron bridge on the left bank, downstream side. The length of the chain from the end of the weight to the marker is 51.35 feet. The observer is Clyde Lowrey.

The channel is straight for 1,500 feet above the station and for one-half mile below. The current is swift. The right bank overflows at extreme high water. The left bank overflows only under the approach to the bridge. The bed is nearly all rock, and there is but one channel.

Bench mark No. 1 is the downstream end of the crossbeam 100 feet from the initial point for soundings and is 42.85 feet above gage datum. Bench mark No. 2 is a copper plug set in a solid rock about 6 feet from the edge of the water and 250 feet below the bridge on the left bank. Its elevation is 6.44 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Cahaba River at Centerville, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 8	J. M. Giles	5.15	1,637
April 9	do	6.65	2,225
June 17	do	2.05	416
June 18	do	2.00	394
July 20	do	3.23	757
July 21	do	2.36	516
September 28	do	1.31	212
September 29	do	1.30	218
November 9	do	1.32	203
November 10	do	1.40	223

Mean daily gage height, in feet, of Cahaba River at Centerville, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.90	5.80	23.80	8.20	3.00	2.80	2.40	4.80	1.50	1.30	1.60	1.40
2	6.40	4.90	18.10	7.00	3.10	2.70	2.20	6.10	1.50	1.20	1.60	1.40
3	7.70	6.40	12.60	6.30	3.00	2.70	2.10	4.60	1.50	1.20	1.50	1.40
4	7.40	8.80	12.00	5.80	2.90	2.80	2.10	3.00	1.50	1.30	1.50	1.40
5	6.10	12.90	13.30	5.10	2.80	2.90	2.00	2.90	1.50	1.30	1.50	1.40
6	5.60	12.00	11.10	4.90	2.70	2.90	1.90	2.40	1.50	1.30	1.50	1.50
7	4.90	20.60	9.80	4.70	2.80	3.10	3.60	2.80	1.50	1.30	1.40	1.60
8	4.50	31.60	12.30	4.70	3.10	3.20	3.40	2.90	1.40	2.80	1.40	1.60
9	4.30	26.80	15.10	6.60	3.00	3.40	2.80	2.80	1.40	2.10	1.30	1.50
10	4.10	20.50	12.40	6.30	2.80	2.80	2.90	3.70	1.40	1.80	1.30	1.50
11	10.60	22.00	16.30	5.60	2.70	2.90	2.80	2.10	1.40	1.60	1.40	1.50
12	14.70	20.50	15.80	5.20	3.30	2.80	2.90	1.90	1.40	1.50	1.60	1.50
13	11.30	16.90	15.20	4.60	5.00	2.50	2.80	1.90	1.40	1.50	1.70	1.50
14	7.90	11.70	14.60	5.80	12.90	2.40	2.80	1.80	1.60	1.50	1.60	1.60
15	6.50	9.60	13.90	5.70	17.80	2.30	2.30	2.70	1.70	1.40	1.50	1.60
16	5.80	22.90	12.20	4.80	17.70	2.20	2.10	3.50	1.70	1.40	1.30	1.60
17	5.30	26.40	10.90	4.40	9.40	2.10	2.00	5.10	1.60	1.40	1.30	1.60
18	4.90	24.50	8.20	4.20	7.20	2.00	2.00	4.70	1.60	1.40	1.30	1.50
19	4.60	16.60	7.30	4.00	5.80	2.00	2.80	3.80	1.50	1.30	1.40	1.50
20	4.30	12.40	6.80	3.90	4.90	1.90	3.80	3.40	1.50	1.30	1.40	1.50
21	4.20	9.90	6.30	5.50	4.40	1.90	2.30	2.70	1.60	1.30	1.40	1.50
22	4.00	8.10	7.00	5.10	4.00	2.70	1.90	2.40	1.60	1.30	1.30	1.60
23	3.90	7.30	6.80	4.80	3.70	3.40	1.70	2.20	1.50	1.30	1.30	1.60
24	3.80	6.70	6.30	3.90	3.50	2.60	1.60	2.10	1.50	1.30	1.40	1.60
25	4.00	5.80	5.90	3.70	3.20	2.80	2.40	2.00	1.50	1.30	1.40	1.70
26	3.80	5.20	5.40	3.60	3.10	2.90	1.70	1.90	1.50	1.30	1.40	2.00
27	3.80	5.90	5.10	3.50	3.00	3.40	1.70	1.80	1.50	1.30	1.40	1.90
28	6.00	27.20	5.10	3.30	2.90	3.30	1.60	1.80	1.40	1.30	1.40	1.70
29	6.40	.....	6.30	3.20	2.80	3.10	1.60	1.60	1.30	1.30	1.40	1.50
30	6.20	.....	7.70	3.00	2.70	2.60	1.50	1.50	1.30	1.20	1.40	1.50
31	5.90	.....	9.20	.....	2.90	.....	5.70	1.50	.....	1.50	.....	1.50

Rating table for Cahaba River at Centerville, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	143	1.9	365	2.8	676	3.7	1,035
1.1	163	2.0	397	2.9	715	3.8	1,075
1.2	184	2.1	430	3.0	755	3.9	1,115
1.3	206	2.2	463	3.1	795	4.0	1,155
1.4	229	2.3	497	3.2	835	4.1	1,195
1.5	253	2.4	532	3.3	875	4.2	1,235
1.6	279	2.5	568	3.4	915	4.3	1,275
1.7	306	2.6	604	3.5	955	4.4	1,315
1.8	335	2.7	640	3.6	995		

Table is made from measurements between gage heights 1.30 and 6.65 feet. Above 3 feet gage height the difference is 40 per tenth.

Estimated monthly discharge of Cahaba River at Centerville, Ala., for 1903.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	5,435	1,075	1,940	1.87	2.16
February	12,195	1,515	5,412	5.20	5.41
March	9,075	1,595	3,849	3.70	4.27
April	2,835	755	1,514	1.46	1.63
May	6,675	640	1,518	1.46	1.68
June	915	365	648	.62	.69
July	1,835	253	560	.54	.62
August	1,995	253	721	.69	.80
September	306	206	252	.24	.27
October	676	184	243	.23	.27
November	306	206	237	.23	.26
December	397	229	268	.26	.30
The year	12,195	184	1,430	1.38	18.36

ALABAMA RIVER AT SELMA, ALA.

This station, which was originally established by the United States Engineer Corps, is now maintained by the United States Weather Bureau. The station is at the iron highway bridge one block from Water street, Selma, Ala. The gage is in two sections. The first section, reading from −3 to +5.1 feet, is fastened to the lower side of the cofferdam on the second pier; the upper section, reading from 5.1 to 55 feet, is bolted to the draw pier. Discharge measurements are made from the bridge and the trestle approach on the left bank. The initial point for soundings is the end of the drawbridge on the right bank, upstream side. The channel above the station is slightly curved for 1,000 feet and straight for 2,000 feet below the station. The velocity is good and the current is regular. The right bank is high and rocky and will not overflow. The left bank is high, but overflows at extreme high water. The bed is mostly soft blue rock, and the water is confined to one channel.

Bench mark No. 1 is an iron bolt driven into the rock bluff 182 feet from the first pier on the road leading to the boat landing; its elevation is 26 feet above the zero of the gage and 88 feet above mean sea level.

Bench mark No. 2 is the top of the capstone of the pivot pier. Its elevation is 56 feet above the zero of the gage.

Bench mark No. 3 is the edge of the coping on the right bank abutment, just under the downstream side of the drawbridge; its elevation is 59.51 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Alabama River at Selma, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 10	J. M. Giles	22.35	59,101
June 19	do	6.45	18,815
November 11	do	1.00	8,290

Mean daily gage height, in feet, of Alabama River at Selma, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.80	7.00	33.50	28.00	9.60	7.00	10.00	3.50	1.50	0.10	−0.20	0.40
2	8.00	6.90	38.00	30.20	9.40	8.00	9.80	4.80	1.60	.00	− .20	.50
3	8.90	6.80	41.00	31.40	8.80	9.60	9.00	6.80	1.60	.00	− .10	.50
4	11.00	7.00	42.60	31.40	8.70	12.70	8.00	6.80	1.40	− .20	.00	.40
5	11.90	7.00	42.80	30.20	8.70	13.50	7.00	6.10	1.40	− .20	.10	.50
6	13.00	9.60	42.00	29.00	8.40	13.20	6.80	5.00	1.20	− .20	.10	.30
7	11.00	14.00	40.20	27.80	7.80	14.50	6.40	5.50	1.00	− .30	.30	.40
8	10.00	23.50	38.50	26.30	7.80	16.00	6.40	5.00	.70	− .30	.20	.40
9	9.50	33.00	36.70	24.50	8.00	17.00	7.60	5.00	.50	− .30	.50	.50
10	8.20	39.00	35.00	22.40	10.00	17.00	8.80	5.40	.40	.00	.90	.50
11	7.00	44.30	34.00	22.20	9.80	17.00	9.00	6.60	.40	.40	1.00	.50
12	7.90	48.00	31.30	20.70	9.00	16.00	8.00	6.10	.30	.50	1.10	.60
13	10.60	49.50	29.80	21.50	11.20	14.00	6.80	5.00	.20	.60	1.00	.80
14	12.80	50.20	27.50	20.80	16.00	11.00	6.60	4.60	.10	.40	1.00	.90
15	13.00	50.60	27.00	20.00	21.00	9.50	6.40	3.30	.10	.20	1.00	.90
16	12.00	49.90	27.00	20.30	25.00	8.60	5.80	3.00	.00	.40	.90	.90
17	11.80	49.00	27.00	20.80	30.00	8.00	6.50	2.80	.60	.40	.90	.90
18	10.00	47.70	26.30	20.90	31.20	7.40	8.80	4.00	.30	.60	.80	.80
19	9.00	47.30	24.00	19.00	29.70	6.80	8.60	5.00	2.20	.60	.70	.60
20	7.90	47.80	21.30	17.60	24.00	6.50	7.00	6.70	2.50	.50	.70	.60
21	7.00	47.90	18.00	15.40	16.50	5.90	6.00	7.70	1.70	.50	.80	.50
22	6.40	47.00	16.00	17.20	11.80	5.90	5.00	7.40	1.50	.40	.80	.60
23	6.00	45.00	16.00	17.50	9.80	6.40	4.50	5.00	1.50	.40	.80	1.00
24	5.80	42.00	19.00	14.80	8.70	7.40	3.80	4.00	1.30	.40	.70	1.00
25	5.40	38.00	23.00	12.80	7.90	7.50	3.60	3.10	.80	.50	.80	1.00
26	5.20	33.80	25.10	11.70	7.60	7.50	3.50	3.00	.60	.60	.90	1.10
27	5.20	28.00	26.30	11.00	7.00	7.00	3.70	2.60	.60	.50	1.00	2.00
28	5.80	28.90	26.70	10.80	6.80	6.80	4.00	2.00	.60	.20	.80	3.00
29	6.00	.....	25.40	10.00	6.40	9.50	4.00	1.70	.60	.00	.50	3.10
30	7.00	.....	25.20	9.80	6.70	11.40	3.50	1.60	.50	.00	.50	2.60
31	7.20	.....	26.20	.....	6.50	.....	3.50	1.50	.....	.00	.....	1.80

Rating table for Alabama River at Selma, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.3	6,262	1.9	9,070	5.2	15,450	9.6	25,140
− .2	6,364	2.0	9,230	5.4	15,870	9.8	25,600
− .1	6,470	2.1	9,390	5.6	16,290	10.0	26,060
.0	6,580	2.2	9,550	5.8	16,720	10.2	26,520
.1	6,692	2.3	9,710	6.0	17,160	10.4	26,980
.2	6,806	2.4	9,880	6.2	17,600	10.6	27,440
.3	6,922	2.5	10,050	6.4	18,040	10.8	27,900
.4	7,040	2.6	10,220	6.6	18,480	11.0	28,360
.5	7,160	2.7	10,400	6.8	18,920	11.2	28,820
.6	7,282	2.8	10,590	7.0	19,360	11.4	29,280
.7	7,406	2.9	10,780	7.2	19,800	11.6	29,740
.8	7,532	3.0	10,970	7.4	20,240	11.8	30,200
.9	7,660	3.2	11,370	7.6	20,680	12.0	30,660
1.0	7,790	3.4	11,770	7.8	21,120	12.5	31,860
1.1	7,920	3.6	12,170	8.0	21,560	13.0	33,110
1.2	8,060	3.8	12,570	8.2	22,000	13.5	34,410
1.3	8,200	4.0	12,970	8.4	22,440	14.0	35,750
1.4	8,340	4.2	13,370	8.6	22,880	15.0	38,450
1.5	8,480	4.4	13,770	8.8	23,320	16.0	41,200
1.6	8,620	4.6	14,190	9.0	23,760		
1.7	8,770	4.8	14,610	9.2	24,220		
1.8	8,920	5.0	15,030	9.4	24,680		

Tangent at 15 feet with differences of 275 second-feet per tenth.

Estimated monthly discharge of Alabama River at Selma, Ala., for 1903.

[Drainage area, 15,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	33,110	15,450	23,039	1.50	1.73
February	136,350	18,920	90,958	5.91	6.15
March	114,900	41,200	78,139	5.07	5.85
April	83,560	25,600	53,852	3.50	3.90
May	83,000	18,040	33,338	2.16	2.49
June	43,950	16,940	27,142	1.76	1.96
July	26,060	11,970	18,122	1.18	1.36
August	20,900	8,480	14,205	.92	1.06
September	10,050	6,580	7,781	.51	.57
October	7,282	6,262	6,835	.44	.51
November	7,920	6,364	7,310	.47	.52
December	11,170	6,922	7,801	.51	.59
The year	136,350	6,262	30,710	1.99	26.69

ALABAMA RIVER AT MONTGOMERY, ALA.

A gage rod was established by the United States Engineer Corps a number of years ago at the Montgomery wharf, near the union passenger station, at the foot of Commerce street. The readings are now taken by the Weather Bureau and are furnished to this Survey. The gage rod is in six sections, as follows: Section 1, from −2 to +10 feet, on the fender pile at the face of the wharf, 108 feet from the lower end; section 2, from 10 to 15 feet, at the upper end of the pile protection to the Louisville and Nashville Railroad bank at the corner pile, the 15-foot mark being 1.1 feet above the top of the pile; section 3, 15 to 27 feet, on the bent in the center of the drain on the lower side of the Commerce street sewer; section 4, 27 to 36 feet, on the upper side of the sewer, on the third bent; section 5, 36 to 46 feet, on the same side of the sewer, on the sixth bent; section 6, 46 to 50 feet, on the same side of the sewer, on the seventh bent. The rods are of pine timber, painted, and graduated to feet and tenths. There are also two new sections, 15 to 25 feet and 25 to 37 feet, on trees about 50 yards south of the old gage. The bench mark is the northeast corner of the stone doorsill in the north door of Windsor Hotel, on Commerce street. It is 59.7 feet above the zero of the gage, and is 163.4 feet above sea level. The high-water mark for Montgomery is 59.7 feet, and was reached in April, 1886. The danger line

is placed at 35 feet. The width of the river at low water is 690 feet. The only point where measurements can be made is at the iron bridge of the Louisville and Nashville Railroad, about 3 miles above Montgomery. This bridge is 60.6 feet above low water, with three spans over the river, the center one being a draw or turn span.

The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Mean daily gage height, in feet, of Alabama River at Montgomery, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.20	5.40	33.70	28.00	6.90	6.20	6.90	3.90	1.60	0.40	0.30	0.50
2	6.40	5.40	38.30	29.50	6.70	8.00	7.40	5.60	1.50	.30	.40	.40
3	7.80	5.50	39.70	29.50	6.60	11.00	6.60	5.80	1.30	.30	.50	.40
4	9.50	5.50	38.80	28.20	6.80	13.50	5.50	5.00	1.60	.30	.60	.40
5	9.40	7.10	37.00	26.30	6.40	11.00	5.40	4.00	1.10	.30	.70	.40
6	8.80	12.00	35.50	24.80	5.90	11.60	5.40	3.30	.90	.30	.70	.40
7	8.10	16.00	33.00	23.30	5.80	13.70	5.20	4.00	.80	.20	.80	.50
8	7.40	27.50	31.40	20.90	6.90	15.00	5.80	4.50	.70	.30	.80	.50
9	6.60	39.60	30.70	18.30	7.90	14.90	6.40	5.30	.70	.80	.90	.60
10	5.60	44.50	28.80	18.90	7.70	15.30	6.50	5.30	.60	.80	1.40	.70
11	5.30	45.90	26.20	19.00	7.10	13.90	5.80	4.60	.50	.70	1.40	.80
12	7.80	47.50	23.00	18.80	6.50	11.50	5.10	3.50	.40	.70	1.20	.90
13	9.80	48.50	21.00	15.90	7.70	9.30	4.70	2.60	.50	.50	1.10	.90
14	9.90	47.50	20.00	15.50	12.80	7.40	4.50	2.20	.40	.60	1.10	.90
15	9.80	45.30	22.40	16.70	18.00	6.90	4.50	2.00	.50	.50	1.10	1.00
16	9.30	42.00	22.00	18.00	24.60	6.50	5.40	1.80	.50	.40	1.00	.90
17	8.20	41.00	21.50	18.90	28.50	5.80	7.70	2.40	1.90	.50	1.00	.90
18	6.90	43.00	20.00	17.00	26.00	5.20	7.50	4.00	2.30	.50	1.00	.80
19	6.00	44.70	17.00	14.70	18.50	4.90	5.70	5.50	2.10	.60	1.00	.60
20	5.30	44.10	15.00	10.70	11.00	4.50	4.50	6.50	1.50	.60	.90	.60
21	5.00	42.00	13.50	14.80	8.40	4.30	3.90	5.90	1.50	.50	.80	.90
22	4.70	39.00	11.90	15.80	7.30	5.00	3.40	3.80	1.60	.50	.80	1.00
23	4.40	35.50	15.50	12.90	6.70	6.00	3.00	2.60	1.30	.40	.80	1.10
24	4.10	31.40	20.00	10.00	6.20	5.80	2.80	2.00	1.10	.80	.90	1.00
25	4.10	27.30	22.80	9.20	5.80	4.90	2.70	1.60	.90	.70	.90	1.20
26	4.00	21.00	24.10	8.50	5.50	4.60	3.30	1.30	.80	.50	.80	1.70
27	3.90	14.00	24.10	8.30	5.20	5.30	3.30	1.00	.60	.40	.70	2.60
28	4.50	22.40	22.80	7.90	5.00	9.00	3.40	.70	.60	.40	.60	2.50
29	5.20	.....	21.30	7.30	4.80	8.00	2.80	.50	.40	.30	.60	2.10
30	5.50	.....	22.00	7.10	4.80	7.60	2.50	1.50	.50	.30	.50	1.60
31	5.50	.....	25.00	.....	5.00	.....	2.50	1.50	.....	.40	.....	1.30

TALLAPOOSA RIVER AT MILSTEAD, ALA.

A gaging station was established on August 7, 1897, at the bridge of the Tallassee and Montgomery Railway, about one-fourth of a mile from Milstead, Ala. The bridge is of iron, two spans of about 155 feet each, with short wooden trestles at each end. The initial point for soundings is the end of the iron bridge, on the left bank, downstream side. The rod of the wire gage is fastened to the outside of the guard rail on the downstream side of the bridge. The bench

mark is the top of the second crossbeam from the left-bank pier at the downstream end, and is 60 feet above datum. The channel is straight at the bridge and bends above and below. The current is sluggish at low water and obstructed by the center pier of the bridge. The banks are high, but overflow at extreme high water for several hundred feet on each side. The bed is fairly constant, and all the water is confined to the main channel by railroad embankments.

The large new dams at Tallassee Falls—6 and 9 miles, respectively, above this station—almost stop the flow of the river at certain times, so that discharge measurements at Milstead do not represent the amount of water furnished by the stream. The station at Sturdevant, Ala., about 30 miles above these dams, has been established to replace the station at Milstead, which was discontinued April 30, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Mean daily gage height, in feet, of Tallapoosa River at Milstead, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	5.10	3.50	37.70	21.50	17	3.70	22.70	9.20	8.00
2	4.40	3.20	32.60	18.70	18	3.50	33.90	8.00	7.40
3	6.40	3.00	23.60	13.50	19	3.40	27.00	7.50	6.50
4	5.40	3.50	11.20	10.20	20	3.20	22.00	6.90	6.40
5	4.90	5.00	14.10	9.00	21	3.10	14.40	6.70	17.20
6	4.40	6.60	12.00	8.30	22	3.00	9.40	8.30	9.80
7	3.80	5.60	11.50	7.60	23	2.90	8.00	12.50	8.40
8	3.60	36.50	10.80	8.90	24	2.80	7.20	20.50	6.30
9	3.20	44.50	10.50	11.70	25	3.00	6.80	19.90	5.80
10	3.00	34.00	10.10	16.00	26	3.10	6.40	16.50	5.90
11	3.20	27.10	10.00	13.40	27	3.00	6.20	21.40	6.20
12	6.90	37.80	12.00	9.50	28	3.70	25.00	8.70	5.40
13	6.80	32.70	10.30	8.90	29	4.50	.....	8.50	5.20
14	6.00	22.60	11.10	13.30	30	4.20	.....	19.40	4.80
15	4.70	14.90	9.70	11.50	31	3.90	.....	23.70	.....
16	4.00	11.00	9.20	9.70					

TALLAPOOSA RIVER AT STURDEVANT, ALA.

This station was established July 19, 1900, by J. R. Hall. It is located at the Columbus and Western Railroad bridge, a fourth of a mile west of Sturdevant. This railroad belongs to the Central of Georgia Railway. This station, being above the big new dams at Tallassee, is intended to replace Milstead station. Map and profile of Tallapoosa River is published in Twenty-second Annual Report, part 4. The gage is a vertical timber in two sections. The first section, reading from zero to 5.2 feet, is fastened to a post on the east bank about 20 feet below the bridge. The second section, reading from 5 to 20 feet, is fastened to the east side of the first pier in the water on the east bank. The gage is read once each day by B. F. Neighbors. At ordinary stages discharge measurements are made from a footway supported by the bracing of the lower chord of the deck bridge. At

low stages measurements are made from a boat about 2,000 feet upstream. The initial point for soundings is the end of the iron bridge on the east or left bank, downstream side. Distances are marked in white paint along the hand rail of the footway.

The channel is slightly curved directly above the bridge and for about one-half mile below. The current is swift and much broken by shoals below the bridge, but is sluggish at low stages at and near the station. Both banks are high, the right overflowing for about 150 feet and the left for about 200 feet. The bed is of rock and gravel and is probably permanent.

Bench mark No. 1 is a wire nail driven in the southwest corner of the second pier on the east bank. Its elevation is 14.20 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in solid rock in the bed of the river about 80 feet below the bridge, at a point 400 feet from the end of the bridge at the left bank. This is solid bed rock projecting above the water at ordinary stages. Its elevation is 4.89 feet above the zero of the gage. Bench mark No. 3 is a white paint mark on the top of the downstream end of the lower crossbeam at a point 278 feet from the initial point for soundings. Its elevation is 27.65 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tallapoosa River at Sturdevant, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 22	J. M. Giles	4.00	4,580
July 25	do	2.45	2,247
August 22	do	2.20	1,837
August 24	do	1.88	1,485
Do	do	1.86	1,616
October 3	do	1.05	834
Do	do	1.05	835
November 24	do	1.58	1,148

Mean daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	2.90	11.00	9.00	3.80	3.50	3.60	4.70	2.10	1.10	1.20	1.40
2	3.70	2.70	9.20	7.80	3.80	5.00	3.50	4.10	1.90	1.10	1.30	1.40
3	3.60	2.60	7.60	5.90	3.70	4.50	3.40	3.80	1.60	1.10	1.50	1.50
4	3.50	3.20	6.50	5.50	3.70	4.20	3.30	3.50	1.40	1.00	1.80	1.50
5	3.50	4.10	5.90	5.20	3.90	6.20	4.40	3.20	1.30	1.00	2.00	1.50
6	3.40	4.30	5.50	5.10	5.40	8.10	3.60	3.40	1.20	1.00	2.10	1.60
7	3.30	4.50	5.40	5.00	4.90	5.30	4.00	3.20	1.20	.90	2.10	1.60

Mean daily gage height, in feet, of Tallapoosa River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	3.20	19.20	5.10	4.90	4.50	5.00	4.40	3.00	1.10	1.10	2.00	1.60
9	3.10	14.00	4.90	8.10	4.30	4.80	4.50	2.80	1.10	2.70	1.80	1.70
10	3.00	10.00	5.30	7.60	4.10	4.50	3.60	2.70	1.00	2.00	1.60	1.60
11	3.10	12.10	6.50	6.00	4.00	5.50	3.30	2.50	1.00	1.50	1.50	1.80
12	3.70	13.80	5.80	5.50	4.00	4.50	3.10	2.20	.90	1.20	1.40	1.7
13	3.50	9.30	5.30	6.00	6.50	4.00	3.00	2.10	.90	1.00	2.10	1.70
14	3.30	6.60	5.10	6.20	6.30	3.80	3.20	2.00	1.00	.90	1.90	1.70
15	3.20	5.40	5.00	5.60	13.70	3.60	3.40	1.90	2.10	.90	1.80	1.60
16	3.00	4.80	4.90	5.20	9.50	3.50	3.10	3.00	3.20	1.00	1.70	1.60
17	2.80	14.60	4.80	4.70	6.80	3.30	2.90	3.80	2.80	1.20	1.60	1.60
18	2.70	12.00	4.70	4.50	5.30	3.20	2.70	5.60	2.40	1.50	1.60	1.60
19	2.60	10.20	4.60	4.40	4.90	3.10	2.60	3.80	2.20	1.40	1.80	1.50
20	2.60	8.90	4.50	10.60	4.40	3.10	2.50	3.00	2.00	1.30	1.70	1.90
21	2.50	5.20	4.50	6.50	4.20	3.00	2.40	2.50	1.90	1.20	1.70	2.00
22	2.50	4.60	5.30	5.40	4.10	2.90	2.30	2.30	1.70	1.10	1.70	1.9
23	2.50	4.20	8.40	5.10	3.80	2.90	2.20	2.20	1.50	1.10	1.60	1.90
24	2.50	4.00	9.50	4.60	3.70	2.80	2.10	2.10	1.40	1.00	1.60	1.90
25	2.50	3.80	8.20	4.20	3.60	2.80	2.10	1.80	1.40	1.00	1.60	2.10
26	2.50	3.70	6.00	4.10	3.50	3.00	2.40	1.70	1.30	1.00	1.50	2.00
27	2.50	3.70	5.60	4.00	3.50	5.80	2.20	1.60	1.30	.90	1.50	2.50
28	3.00	16.00	5.40	3.90	3.40	5.10	2.10	1.50	1.20	.90	1.50	2.20
29	3.10	.....	5.30	3.90	3.30	4.50	2.00	1.50	1.20	.90	1.50	2.0
30	3.10	.....	10.00	3.90	3.30	4.00	1.90	2.00	1.20	1.00	1.50	1.90
31	3.10	.....	9.80	.....	3.20	.....	5.80	2.40	.....	1.10	.....	1.70

Rating table for Tallapoosa River at Sturdevant, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet*
0.9	765	1.7	1,288	2.5	2,320	3.3	3,520
1.0	810	1.8	1,390	2.6	2,470	3.4	3,670
1.1	859	1.9	1,500	2.7	2,620	3.5	3,820
1.2	912	2.0	1,620	2.8	2,770	3.6	3,970
1.3	970	2.1	1,750	2.9	2,920	3.7	4,120
1.4	1,036	2.2	1,885	3.0	3,070	3.8	4,270
1.5	1,110	2.3	2,025	3.1	3,220	3.9	4,420
1.6	1,194	2.4	2,170	3.2	3,370	4.0	4,570

Tangent at 2.4, with differences of 150 second-feet per tenth.

Estimated monthly discharge of Tallapoosa River at Sturdevant, Ala., for 1903.

[Drainage area, 2,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,120	2,320	3,128	1.25	1.44
February	27,370	2,470	9,841	3.94	4.10
March	15,070	5,320	8,035	3.21	3.70
April	14,470	4,420	6,988	2.79	3.11
May	19,120	3,370	5,688	2.27	2.62
June	10,720	2,770	4,845	1.94	2.16
July	7,270	1,500	3,204	1.28	1.48
August	6,970	1,110	2,771	1.11	1.28
September	3,370	765	1,271	.51	.57
October	2,620	765	939	.37	.43
November	1,750	912	1,285	.51	.57
December	2,920	1,036	1,410	.56	.65
The year	27,370	765	4,117	1.645	22.11

HILLABEE CREEK NEAR ALEXANDER, ALA.

This station, which was established August 29, 1900, by J. R. Hall is located 6½ miles northeast of Alexander, on the road leading from that town to Newsite. The gage is graduated to feet and tenths, is placed vertically, and is in two sections. The short section, which reads from 0 to 5.50 feet, is fastened to a post in the edge of the water on the north bank, 20 feet from the upstream side of the bridge. The long section, which reads from 5.50 to 16 feet, is fastened to the upstream end of the first pier on the north bank. Both sections can be easily read from the north approach to the bridge. The initial point for soundings is on the south side of the first pier on the north bank. The gage is referred to a bench mark at the top of the chord on the downstream side of the bridge at the second pier from the north bank, and is 27.6 feet above the zero of the gage. The bridge is in three spans, having a total length of 276 feet, with a north approach of 116 feet and a south approach of 124 feet, making a total, over all, of 516 feet. The observer is J. H. Chisolm, a farmer, whose post-office address is Alexander, Ala. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Hillabee Creek near Alexander, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 21	J. M. Giles	2.65	766
July 24	do	1.50	212
August 21	do	1.50	213
Do	do	1.50	205
October 5	do	.94	84
November 25	do	1.15	114

Mean daily gage height, in feet, of Hillabee Creek near Alexander, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.90	1.60	.....	2.20	2.20	2.30	2.40	2.40	2.70	1.10	1.00	1.10
2	4.00	1.60	.....	2.10	2.30	2.30	2.20	4.00	2.60	1.10	1.00	1.00
3	3.60	1.50	.....	2.20	2.30	2.70	3.30	4.00	2.40	1.10	1.00	1.00
4	3.00	3.00	.....	2.10	2.30	2.70	3.30	1.80	2.40	1.00	1.50	1.90
5	2.50	2.00	.....	2.70	2.30	3.80	2.10	1.80	2.40	1.00	1.60	1.90
6	1.80	1.90	.....	2.30	2.90	3.50	2.00	2.00	2.80	1.10	1.30	1.00
7	1.80	4.00	.....	2.60	3.10	2.80	2.00	1.80	2.60	1.10	1.20	1.00
8	1.90	16.50	.....	3.10	2.10	2.80	2.90	1.70	2.40	1.10	1.00	1.00
9	1.90	(a)	.....	2.60	2.20	2.90	3.40	2.00	2.00	1.00	1.00	1.00
10	1.90	.....	.....	2.50	2.50	2.80	2.40	2.00	1.90	1.00	1.10	1.10
11	3.00	.....	.....	2.20	2.90	3.50	2.70	1.80	1.70	1.00	1.20	1.10
12	2.10	.....	.....	2.40	2.90	2.10	2.60	1.90	1.50	1.00	1.90	1.10
13	2.00	.....	.....	2.40	4.50	2.00	2.20	1.90	1.80	1.00	1.20	1.00
14	1.70	.....	.....	2.80	4.20	2.80	2.00	1.60	1.30	1.00	1.50	1.10
15	1.70	.....	.....	2.70	12.00	1.80	2.00	1.60	1.30	1.00	1.30	1.20
16	1.70	.....	.....	2.60	4.60	1.70	1.90	1.60	1.40	1.10	1.30	1.20
17	1.60	.....	.....	2.60	3.90	1.70	1.90	1.60	1.30	1.20	1.70	1.10
18	1.60	.....	.....	2.60	2.90	1.70	1.90	1.60	1.30	1.10	1.70	1.10
19	1.50	.....	.....	2.70	4.80	1.60	2.20	1.70	1.30	1.00	1.50	1.20
20	1.70	.....	.....	11.00	2.80	1.60	2.00	1.70	1.20	1.00	1.20	1.30
21	1.70	.....	.....	2.80	2.70	2.20	2.00	1.70	1.20	1.00	1.20	1.30
22	1.80	.....	3.10	2.80	2.60	5.90	2.00	1.70	1.20	1.00	1.50	1.30
23	1.90	.....	3.60	2.70	2.40	1.90	2.00	1.60	1.20	1.00	1.50	1.20
24	1.80	.....	3.30	2.50	2.00	1.80	2.00	1.60	1.20	1.00	1.50	1.20
25	1.80	.....	3.10	2.20	1.90	1.80	2.00	1.50	1.10	1.00	1.50	1.10
26	1.80	.....	3.00	2.90	1.80	3.80	1.80	1.50	1.00	1.00	1.50	1.30
27	1.90	.....	2.90	2.70	1.80	4.00	1.80	1.50	1.00	1.00	1.50	1.30
28	3.00	.....	2.80	2.70	1.80	3.80	1.90	1.40	1.00	1.00	1.50	1.40
29	2.70	.....	3.10	2.50	1.90	3.60	1.90	1.40	1.10	1.00	1.20	1.30
30	2.50	.....	3.60	2.50	1.90	3.00	1.80	2.40	1.10	1.00	1.20	1.30
31	1.90	.....	4.10	.....	1.80	.....	3.80	2.80	.....	1.00	.....	1.30

(a) Gage washed out.

Rating table for Hillabee Creek at Alexander, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.9	80	2.0	425	3.1	920	4.2	1,415
1.0	90	2.1	470	3.2	965	4.3	1,460
1.1	106	2.2	515	3.3	1,010	4.4	1,505
1.2	126	2.3	560	3.4	1,055	4.5	1,550
1.3	150	2.4	605	3.5	1,100	4.6	1,595
1.4	178	2.5	650	3.6	1,145	4.7	1,640
1.5	210	2.6	695	3.7	1,190	4.8	1,685
1.6	248	2.7	740	3.8	1,235	4.9	1,730
1.7	290	2.8	785	3.9	1,280	5.0	1,775
1.8	335	2.9	830	4.0	1,325	5.5	2,000
1.9	380	3.0	875	4.1	1,370	11.0	4,475

No measurements above 2.65 feet gage height. Table is only approximate above this point.

Tangent at 2.9 with difference of 45 per tenth.

Estimated monthly discharge of Hillabee Creek at Alexander, Ala., for 1903.

[Drainage area, 214 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,325	210	479	2.24	2.58
February 1 to 8			1,333	6.23	1.85
March 22 to 31			992	4.64	1.72
April	4,475	470	796	3.72	4.15
May	4,925	335	865	4.04	4.66
June	2,180	248	739	3.45	3.85
July	1,235	335	547	2.56	2.95
August	1,325	178	393	1.84	2.12
September	785	90	298	1.39	1.55
October	126	90	95	.44	.51
November	380	90	173	.81	.90
December	380	90	133	.62	.71

TALLADEGA CREEK AT NOTTINGHAM, ALA.

This station was established August 16, 1900, by J. R. Hall. The station is maintained by the Alabama geological survey. It is located on the Southern Railway bridge, a fourth of a mile from the depot at Nottingham, Ala., and 1 mile north of Alpine, Ala. The gage, which is graduated to feet and tenths and is 20 feet long, is fastened vertically to a tree on the right bank, about 50 feet upstream from the bridge. The observer is R. M. McClatchy, station agent at Nottingham.

The initial point for soundings is end of iron bridge, upstream, right bank. The channel is straight for about 500 feet above and below the station and the current is sluggish at low stages. The right bank is high and does not overflow; the left bank is lower than the right and overflows at high stages; but all water passes beneath the bridge. The bed of the stream is of sand and silt and is fairly constant.

Bench mark No. 1 is a nail on the upstream corner of the right bank abutment; its elevation is 14.25 feet above the zero of the gage. Bench mark No. 2 is a copper plug set in the limestone rock at a large spring 335 feet above the railway track on the right bank; its elevation is 6.28 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Talladega Creek at Nottingham, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 25	J. M. Giles	2.05	243
July 27	do	1.37	111
August 20	do	1.30	116
October 2	do	1.00	57
November 14	do	1.21	80

Mean daily gage height, in feet, of Talladega Creek at Nottingham, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.70	1.30	6.40	3.80	2.00	2.50	1.90	1.70	1.00	1.00	1.00	1.10
2	2.10	1.30	4.20	3.40	1.90	2.30	1.80	1.80	1.00	1.00	1.00	1.10
3	2.20	1.30	4.00	3.20	1.80	2.00	1.70	1.60	.90	1.00	1.00	1.10
4	2.10	2.30	3.80	3.00	1.80	1.90	2.00	1.60	.90	1.00	1.00	1.10
5	1.90	2.10	3.50	2.80	1.80	1.80	2.50	1.40	.90	1.00	1.00	1.10
6	1.80	1.70	4.20	2.60	1.80	2.20	2.00	1.50	.90	1.00	1.00	1.20
7	1.60	6.80	3.40	2.50	2.80	2.00	1.80	1.50	.90	1.00	1.00	1.10
8	1.50	13.00	3.20	2.40	2.30	1.80	1.70	1.40	.90	1.60	1.10	1.10
9	1.30	5.50	3.20	2.20	2.00	1.80	2.00	1.40	.90	1.50	1.10	1.10
10	1.20	3.60	3.50	2.00	1.90	1.70	1.80	1.30	.90	1.30	1.10	1.10
11	1.50	9.20	3.60	2.20	1.80	3.60	1.80	1.30	.90	1.10	1.10	1.10
12	2.70	6.50	3.50	3.00	1.80	2.20	1.80	1.30	.90	1.00	1.50	1.10
13	1.80	3.80	3.30	3.20	2.80	2.00	1.70	1.30	.90	1.00	1.50	1.10
14	1.60	3.20	3.60	3.00	4.10	1.80	1.60	1.30	.90	1.00	1.20	1.10
15	1.50	2.80	3.30	2.80	10.80	1.80	1.50	1.80	.90	1.10	1.20	1.10
16	1.40	7.50	3.40	2.60	5.20	1.80	1.50	1.50	1.00	1.10	1.20	1.10
17	1.40	10.00	3.20	2.50	3.50	1.80	1.50	1.30	1.50	1.20	1.20	1.10
18	1.50	4.40	2.90	2.50	2.90	1.70	1.50	1.30	1.20	1.20	1.20	1.10
19	1.30	3.50	2.80	2.40	2.70	1.60	1.50	1.40	1.20	1.20	1.20	1.10
20	1.30	3.10	2.70	4.70	2.60	1.50	1.80	1.40	1.20	1.20	1.20	1.10
21	1.20	2.80	3.00	3.00	2.40	1.50	1.40	1.30	1.10	1.20	1.20	1.10
22	1.20	2.60	3.50	2.50	2.20	2.50	1.40	1.20	1.10	1.20	1.20	1.10
23	1.20	2.30	5.50	2.40	2.00	1.80	1.40	1.20	1.10	1.20	1.10	1.10
24	1.20	2.20	4.00	2.30	2.00	1.60	1.40	1.10	1.10	1.20	1.10	1.10
25	1.20	2.20	3.50	2.20	2.00	1.50	1.40	1.10	1.00	1.10	1.10	1.10
26	1.20	2.20	3.10	2.20	2.00	1.70	1.20	1.00	1.00	1.10	1.10	1.10
27	1.20	2.30	2.90	2.10	2.00	2.50	1.30	1.00	1.00	1.10	1.10	1.10
28	1.60	16.00	2.70	2.00	1.90	6.00	1.50	1.00	1.00	1.00	1.10	1.10
29	1.50	.....	2.90	2.00	1.90	2.50	1.40	1.00	1.00	1.00	1.10	1.10
30	1.40	.....	8.70	2.00	2.80	2.00	1.40	1.00	1.00	1.10	1.10	1.10
31	1.30	.....	4.80	.....	2.30	.....	1.60	1.00	.....	1.10	.....	1.10

Rating table for Talladega Creek at Nottingham, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.9	46	1.5	133	2.1	256	2.7	400
1.0	57	1.6	151	2.2	280	2.8	424
1.1	69	1.7	170	2.3	304	2.9	448
1.2	83	1.8	190	2.4	328	3.0	472
1.3	99	1.9	211	2.5	352		
1.4	116	2.0	233	2.6	376		

No measurements made above 3 feet gage height. Table approximate above that height. Tangent at 2.8 with differences of 24 per tenth.

Estimated monthly discharge of Talladega Creek at Nottingham, Ala., for 1903.

[Drainage area, 156 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	400	83	144	0.92	1.06
February	3,592	99	832	5.33	5.57
March	1,840	400	637	4.08	4.70
April	880	233	388	2.49	2.78
May	2,344	190	387	2.48	2.86
June	1,192	133	265	1.70	1.90
July	352	83	161	1.03	1.19
August	190	57	105	.67	.77
September	133	46	59	.38	.42
October	151	57	74	.47	.54
November	133	57	75	.48	.54
December	83	69	69	.44	.51
The year	3,592	46	266	1.71	22.82

CHOCCOLOCCO CREEK NEAR JENIFER, ALA.

The station was established August 20, 1902, by J. M. Giles. It is located at the Louisville and Nashville bridge, 1¼ miles north of Jenifer, Ala. There are small shoals both above and below the bridge. The gage consists of a vertical 1 by 4 inch pine plank, nailed to a 3 by 8 inch pine timber which is spiked to a birch tree 20 feet upstream from the bridge on the left bank. It reads from 0.30 to 10 feet. The observer is W. J. Tolbert. Discharge measurements are made from the single-span bridge and its trestle approach on the right bank. The initial point for soundings is the end of the bridge on the left bank, and distances are marked with white paint on the upstream guard rail. The channel is straight for 1,500 feet above and below the station and has a width between abutments of 145 feet and 100 feet at low water. The right bank overflows at a gage reading of about 6 feet. The left bank is high and will not overflow except under the bridge. The bed is rocky and not likely to change.

Bench mark No. 1 is the top of a crossbeam at a point 50 feet from the initial point for soundings. Its elevation is 23 feet above the zero of the gage. Bench mark No. 2 is a copper plug in the upstream wing of the abutment; its elevation is 14.19 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Choccolocco Creek near Jenifer, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 23	J. M. Giles	2.25	186
Do	do	2.25	180
August 20	do	2.26	183
August 25	do	2.12	146
October 2	do	1.82	90
November 14	do	2.08	130

Mean daily gage height, in feet, of Choccolocco Creek near Jenifer, Ala., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.00	1.80	1.80	1.90	17		2.10	1.80	1.90	1.90
2		2.00	1.80	1.80	1.80	18		2.10	1.90	1.90	1.90
3		2.00	1.80	1.80	1.80	19		2.00	1.90	1.90	1.90
4		2.00	1.80	1.80	1.80	20	2.20	2.00	1.90	1.90	1.90
5		2.00	1.80	1.90	1.90	21	2.20	1.90	1.90	1.90	1.90
6		2.00	1.80	2.10	1.90	22	2.10	1.90	1.90	1.90	1.90
7		2.00	1.80	2.00	1.90	23	2.10	1.90	1.80	1.90	2.10
8		2.00	2.60	1.90	1.90	24	2.10	1.90	1.80	1.90	2.00
9		1.90	2.10	1.90	1.90	25	2.10	1.90	1.80	1.90	1.90
10		1.90	2.00	1.90	1.90	26	2.10	1.90	1.80	1.90	2.00
11		1.90	2.00	1.80	1.90	27	2.10	1.90	1.80	1.90	2.00
12		1.90	1.90	2.00	1.90	28	2.00	1.90	1.80	1.90	1.90
13		1.90	1.90	2.00	1.90	29	2.10	1.80	1.80	1.90	1.90
14		1.90	1.80	2.00	1.90	30	2.00	1.80	1.80	1.90	1.90
15		1.90	1.80	2.00	1.90	31	2.00		1.80		1.90
16		2.00	1.80	1.90	1.90						

Rating table for Choccolocco Creek near Jenifer, Ala., from August 20 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.8	88	2.1	138	2.4	249
1.9	101	2.2	164	2.5	297
2.0	117	2.3	202	2.6	345

Estimated monthly discharge of Choccolocco Creek near Jenifer, Ala., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
August 20 to 31	164	117	137
September	138	88	108
October	345	88	103
November	138	88	103
December	138	88	102

COOSA RIVER AT RIVERSIDE, ALA.

This station was established September 25, 1896, by M. R. Hall. It is located at the Southern Railroad bridge, Riverside, Ala., about 4 miles below Lock No. 4. The 24-inch boxed chain gage is fastened to the downstream guard rail at a point 570 feet from the initial point for soundings. The length of the chain from the marker to the end of the weight is 35.02 feet. The gage is read once each day by J. W. Foster. Discharge measurements are made from the railway bridge to which the gage is attached. The initial point for soundings is the water face of the abutment on the left bank, downstream side. Distances are marked on the guard rail with white paint. The channel is straight above the station for about 400 feet and below for about 3,000 feet. The current is swift, but is broken by a ledge of rock 300 feet above the bridge. The channel is 614 feet between bridge abutments and is broken by four piers. The width at ordinary stages is about 575 feet. Both banks are high; the left bank is liable to overflow, but all water passes beneath the bridge. The bed of the stream is rocky and permanent and not very rough.

Bench mark No. 1 is the capstone on the circular pier of the turn span, the elevation of which is 26.80 feet above gage datum. Bench mark No. 2 is a copper plug set in solid rock on the right bank, about 100 feet above the bridge. Its elevation is 11.95 feet above gage datum. The observer is paid by the Alabama geological survey.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Coosa River at Riverside, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 16	J. M. Giles	10.75	40,072
April 11	do	8.80	30,710
June 20	do	2.87	7,374
July 22	do	2.30	5,549
August 26	do	1.64	4,001
October 1	do	1.05	2,687
November 13	do	1.37	3,136

Mean daily gage height, in feet, of Coosa River at Riverside, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	4.20	12.90	13.40	4.20	6.10	4.00	3.00	1.25	1.10	1.10	1.20
2	4.00	3.90	14.30	13.60	4.00	7.80	3.80	3.45	1.25	1.05	1.15	1.20
3	4.50	3.85	14.60	13.75	3.85	7.60	3.00	3.20	1.30	1.10	1.25	1.15
4	5.50	5.40	14.60	13.65	3.80	6.90	2.80	3.00	1.40	1.10	1.25	1.15
5	5.55	6.30	14.65	13.50	3.60	7.00	2.70	2.65	1.30	1.05	1.30	1.10
6	5.60	9.40	15.15	12.80	3.50	9.30	2.65	3.00	1.25	1.00	1.35	1.05
7	5.35	11.30	15.00	10.50	3.45	8.60	2.65	3.75	1.25	1.00	1.60	1.05
8	5.10	15.20	14.50	7.75	3.40	10.05	2.60	4.95	1.20	1.30	1.80	1.05
9	4.50	14.80	13.40	8.90	4.00	9.00	2.60	3.50	1.20	1.10	1.90	1.10
10	3.50	14.20	10.90	9.70	4.10	7.30	2.60	2.45	1.20	1.00	1.80	1.15
11	4.20	15.10	9.30	8.80	4.00	5.60	2.55	2.20	1.15	1.20	1.60	1.20
12	5.00	16.00	9.60	7.40	3.65	4.80	2.65	2.00	1.15	1.40	1.40	1.15
13	5.90	15.75	9.70	6.60	3.35	4.40	2.70	1.80	1.10	1.50	1.35	1.15
14	6.60	14.80	11.60	8.90	3.60	5.00	3.30	1.50	1.10	1.30	1.40	1.15
15	6.30	14.10	11.55	10.10	8.70	4.40	6.00	1.50	1.20	1.20	1.40	1.20
16	5.30	14.00	10.80	10.35	7.90	3.90	6.60	1.50	1.25	1.10	1.35	1.20
17	4.45	17.25	9.30	10.00	6.30	3.60	5.50	1.80	1.25	1.10	1.30	1.20
18	3.90	16.40	7.90	8.10	5.25	3.40	3.90	2.00	2.00	1.20	1.25	1.15
19	3.60	15.50	6.85	6.70	4.05	3.10	3.15	3.25	2.05	1.20	1.25	1.15
20	3.40	14.40	6.20	6.30	3.90	2.90	2.75	2.70	1.80	1.30	1.30	1.20
21	3.25	14.20	5.70	5.60	3.70	2.75	2.60	2.35	1.50	1.20	1.25	1.20
22	2.90	14.00	7.10	5.10	3.20	2.65	2.35	2.30	1.35	1.20	1.20	1.25
23	2.85	13.80	9.10	4.80	3.10	2.60	2.20	2.05	1.25	1.25	1.30	1.25
24	2.85	12.20	10.20	4.75	3.00	2.60	2.20	1.90	1.20	1.30	1.30	1.30
25	2.65	8.20	11.00	4.65	2.90	2.65	2.30	1.75	1.20	1.25	1.35	1.40
26	2.70	5.80	11.65	4.55	2.90	2.80	2.20	1.65	1.15	1.20	1.30	1.35
27	2.70	5.40	11.90	4.50	2.90	2.70	2.10	1.50	1.15	1.15	1.30	1.30
28	2.90	8.40	11.55	4.40	2.70	2.65	2.10	1.40	1.20	1.05	1.40	1.30
29	3.40	.....	9.40	4.40	2.60	2.80	2.20	1.40	1.30	1.00	1.35	1.30
30	3.60	.....	10.00	4.30	3.00	5.10	2.15	1.35	1.20	1.05	1.25	1.20
31	3.90	.....	12.35	.....	3.90	.....	2.20	1.30	.....	1.10	.....	1.25

Rating table for Coosa River at Riverside, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	2,620	2.5	6,160	4.0	11,240	5.5	17,110
1.1	2,800	2.6	6,460	4.1	11,610	5.6	17,520
1.2	2,990	2.7	6,770	4.2	11,990	5.7	17,930
1.3	3,180	2.8	7,090	4.3	12,370	5.8	18,340
1.4	3,380	2.9	7,420	4.4	12,750	5.9	18,760
1.5	3,590	3.0	7,750	4.5	13,130	6.0	19,180
1.6	3,810	3.1	8,080	4.6	13,520	6.1	19,600
1.7	4,040	3.2	8,410	4.7	13,910	6.2	20,020
1.8	4,270	3.3	8,750	4.8	14,300	6.3	20,440
1.9	4,510	3.4	9,090	4.9	14,690	6.4	20,860
2.0	4,750	3.5	9,440	5.0	15,090	6.5	21,280
2.1	5,010	3.6	9,790	5.1	15,490	6.6	21,710
2.2	5,290	3.7	10,140	5.2	15,890	6.7	22,140
2.3	5,580	3.8	10,500	5.3	16,290	6.8	22,570
2.4	5,870	3.9	10,870	5.4	16,700	7.0	23,430

Differences above 6.5 feet, 430 per tenth. Table made from measurements between gage height 1.05 and 10.75 feet. Table is approximate above 10.75 feet.

Estimated monthly discharge of Coosa River at Riverside, Ala., for 1903.

[Drainage area, 7,065 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	21,710	6,610	12,066	1.71	1.97
February	67,500	10,680	43,155	6.11	6.36
March	58,470	17,930	40,682	5.76	6.64
April	52,450	12,370	28,983	4.10	4.57
May	30,740	6,460	11,294	1.60	1.84
June	36,540	6,460	15,654	2.22	2.48
July	21,710	5,010	7,994	1.13	1.30
August	14,890	3,180	5,910	.84	.97
September	4,880	2,800	3,211	.45	.50
October	3,590	2,620	2,922	.41	.47
November	4,510	2,800	3,334	.47	.52
December	3,380	2,710	2,983	.42	.48
The year	67,500	2,620	14,849	2.10	28.10

COOSA RIVER AT ROME, GA.

Coosa River is formed by the junction of Etowah and Oostanaula rivers at Rome, Ga. Both the tributary rivers rise in the northern part of Georgia and flow for the most part through a hilly, broken country, well wooded, about one-fourth of the land being under cultivation. The measurements at Rome are made on the Oostanaula and the Etowah just above their junction. The Etowah is measured at the Second Avenue Bridge and the Oostanaula at the Fifth Avenue Bridge in Rome, and the results are added to give the flow of the Coosa. The gage height is taken from the United States Weather Bureau gage at the Fifth Avenue Bridge on the Oostanaula. There is practically no fall on Oostanaula River from the Fifth Avenue Bridge to the junction; hence the gage is used as a Coosa River gage, and the gage heights are considered as gage heights of Coosa River. The gage is a 4 by 6 inch timber in two sections. The first section, 0 to 5 feet, is fastened to the downstream, left-hand corner of the cofferdam around the center pier of the turn span. The second section, 5 to 44 feet, is fastened to the downstream side of the same pier. The zero of the gage is 576 feet above sea level. The United States Weather Bureau has maintained a station here for many years. They now maintain it only from November 1 to April 30, but during 1903 W. M. Towers, the observer, has furnished the Geological Survey with monthly reports of the daily gage height for the entire year. The channel of the Etowah is straight and the current swift and unobstructed, but the Oostanaula is rather sluggish and somewhat obstructed by piers. The banks are high and are liable to overflow at high stages. The station was discontinued December 31, 1903, on account of the uncertain velocity at low stages of the Oostanaula section.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Coosa River at Rome, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 14	O. P. Hall	9.70	16,146
June 5	J. M. Giles	12.55	25,008
July 1	do	2.80	5,305
July 3	do	2.70	4,653
July 18	M. R. Hall	2.85	4,403
September 4	J. M. Giles	.90	2,211
November 28	Hall and Hall	.75	1,892

Mean daily gage height, in feet, of Coosa River at Rome, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.80	28.60	24.90	3.60	6.00	3.00	2.80	1.00	0.40	0.70	0.90
2	3.90	2.80	27.10	22.00	3.60	7.70	3.20	2.60	.90	.40	.70	.90
3	3.90	4.20	24.00	19.50	3.60	9.00	2.90	3.00	.90	.40	.80	.80
4	5.00	8.40	22.30	14.60	3.50	7.50	2.70	3.30	.90	.30	1.50	.70
5	4.30	13.20	20.50	8.00	3.50	11.70	2.60	3.20	.80	.30	1.50	.70
6	4.00	13.40	15.40	7.00	3.30	17.10	2.60	6.20	.70	.30	2.60	.70
7	3.70	9.70	9.90	6.40	3.40	11.70	2.60	4.60	.70	.20	2.00	.70
8	3.00	18.70	7.70	7.70	3.50	6.90	2.40	3.60	.60	.50	1.60	.70
9	2.80	21.60	6.60	10.50	3.50	5.30	2.60	3.40	.60	1.40	1.40	.70
10	2.40	16.50	10.50	8.40	3.40	4.40	2.60	3.00	.60	1.60	1.30	.70
11	3.00	15.10	11.60	6.70	3.30	4.30	2.50	2.60	.60	1.50	1.20	.70
12	5.00	21.80	16.00	6.30	3.30	6.00	2.90	2.20	.60	1.40	1.20	.60
13	5.00	19.60	14.00	5.60	3.00	4.60	5.90	2.00	.60	1.30	1.20	.60
14	4.80	14.50	10.10	14.30	3.00	4.20	11.10	2.00	.60	1.10	1.20	.60
15	3.90	11.10	9.40	13.00	3.10	4.00	6.70	1.60	.60	.90	1.00	.60
16	2.50	8.70	7.80	9.50	3.30	3.80	3.70	4.30	.90	.80	1.00	.60
17	2.40	24.70	6.80	7.40	3.00	3.40	3.50	3.20	1.70	1.20	1.00	.60
18	2.40	28.70	6.30	6.20	3.00	3.00	3.30	2.80	2.00	1.30	1.00	.60
19	2.40	25.50	5.70	5.30	2.80	2.40	3.00	2.20	1.50	1.20	1.50	.60
20	2.40	21.00	5.30	5.70	2.50	2.70	2.90	2.10	1.20	1.00	1.40	.60
21	2.20	15.20	11.00	5.80	2.50	2.50	2.50	2.00	.90	.80	1.30	.70
22	2.00	7.10	11.60	5.50	2.60	2.40	2.40	2.00	.80	.80	1.20	1.30
23	2.00	5.80	16.90	4.90	2.60	2.20	3.00	1.90	.70	.70	1.10	1.30
24	2.00	5.10	22.60	4.70	2.50	2.20	3.00	1.80	.50	.70	1.00	1.00
25	2.00	4.80	20.60	4.40	2.50	2.20	2.60	1.60	.50	.70	1.00	.90
26	2.00	4.50	16.00	4.90	2.30	2.20	2.40	1.50	.50	.60	1.00	.90
27	2.00	4.00	9.70	4.70	2.10	2.40	2.10	1.40	.50	.60	1.00	.90
28	2.40	23.10	6.90	4.00	2.00	6.80	2.00	1.40	.50	.50	.90	.90
29	3.20	.....	7.80	3.90	2.00	6.80	1.80	1.30	.40	.40	.90	.90
30	4.20	.....	22.50	3.70	2.40	4.00	2.30	1.30	.40	.40	.90	.90
31	3.80	.....	27.60	.....	6.70	.....	2.60	1.20	.....	.70	.....	.90

Rating table for Coosa River at Rome, Ga., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	1,280	1.5	2,920	2.8	4,795	5.2	9,112
.3	1,390	1.6	3,060	2.9	4,945	5.4	9,514
.4	1,510	1.7	3,200	3.0	5,095	5.6	9,916
.5	1,630	1.8	3,340	3.2	5,405	5.8	10,318
.6	1,750	1.9	3,480	3.4	5,725	6.0	10,720
.7	1,880	2.0	3,620	3.6	6,055	7.0	12,730
.8	2,010	2.1	3,765	3.8	6,400	8.0	14,740
.9	2,140	2.2	3,910	4.0	6,760	9.0	16,750
1.0	2,270	2.3	4,055	4.2	7,140	10.0	18,760
1.1	2,400	2.4	4,200	4.4	7,520	11.0	20,770
1.2	2,530	2.5	4,345	4.6	7,910	12.0	22,780
1.3	2,660	2.6	4,495	4.8	8,310		
1.4	2,790	2.7	4,645	5.0	8,710		

Constructed from measurements between gage heights 0.60 and 12.55. Measurements of previous years used. Approximate above 10 feet gage height.

Estimated monthly discharge of Coosa River at Rome, Ga., for 1903.

[Drainage area, 4,006 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	8,710	3,620	5,442	1.36	1.57
February	56,347	4,795	25,376	6.34	6.60
March	56,146	9,313	27,111	6.78	7.82
April	48,709	6,225	15,788	3.95	4.41
May	12,127	3,620	5,278	1.32	1.52
June	33,031	3,910	9,594	2.40	2.68
July	20,971	3,340	5,616	1.40	1.61
August	11,122	2,530	4,472	1.12	1.29
September	3,620	1,510	2,002	.50	.56
October	3,060	1,280	2,002	.50	.58
November	3,620	1,880	2,512	.63	.70
December	2,660	1,750	1,985	.50	.58
The year	56,347	1,280	8,932	2.23	29.92

ETOWAH RIVER AT ROME, GA.

Measurements have been made here for several years as a part of Coosa River at Rome. Measurements were referred to a bench mark on the bridge, and the gage put in July 1 was referred to the same bench mark.

The gage was established July 1, 1903, by J. M. Giles. It is located at the Second Avenue Bridge in the city of Rome, Ga., about 1 mile above the mouth of the river. The gage is a vertical timber of 1 by 4 inch pine nailed to a 3 by 8 inch timber, which is driven into the bed of the river and spiked to a birch tree on the left bank about 50 feet below the bridge. The foot marks are numbered with brass figures. During 1903 the observer has been Hal Hawkins. Discharge measurements have been made from the sidewalk on the upstream side of the single-span iron bridge and its approaches. The initial point for soundings is the center of the post at the end of the iron hand rail on the right bank, upstream side. The channel is curved for 1,000 feet above and below the station. Both banks are high and overflow only under the approaches to the bridge. The bed of the stream is of rock and is permanent. The channel is obstructed by the crib of an old pier foundation in the middle of the river.

Bench mark No. 1 is the top of the downstream end of the third crossbeam from the left-bank end of the bridge. Its elevation is 43

feet above the zero of the gage. The station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Etowah River at Rome, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 14	O. P. Hall	9.70	6,316
June 5	J. M. Giles	12.75	17,133
July 1	do	3.27	2,986
July 3	do	3.15	2,704
July 18	M. R. Hall	2.98	2,376
September 4	J. M. Giles	1.20	1,293
November 28	Hall and Hall	1.01	1,080

Mean daily gage height, in feet, of Etowah River at Rome, Ga., for 1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	3.00	1.00	1.00	1.00	1.00	17	3.40	2.90	2.00	1.20	1.30	1.00
2	3.00	3.60	.90	1.00	1.00	1.00	18	3.20	2.70	1.90	(a)	1.50	1.00
3	3.30	3.40	.80	.90	1.30	1.00	19	3.10	2.40	1.80	(a)	2.20	1.00
4	3.00	3.30	.70	.80	1.90	1.00	20	3.00	2.20	1.80	(a)	1.80	1.00
5	3.50	4.00	.60	.80	2.80	1.00	21	2.90	2.00	1.70	(a)	1.30	1.00
6	2.70	3.20	.60	.80	2.20	1.00	22	2.80	1.70	1.60	(a)	1.20	1.00
7	2.70	2.90	.60	.70	2.00	1.00	23	2.70	1.60	1.50	(a)	1.10	1.00
8	3.10	2.70	.60	.80	1.80	1.00	24	2.50	1.60	1.50	(a)	1.10	1.10
9	3.40	2.30	.50	1.00	1.30	1.00	25	2.40	1.50	1.40	(a)	1.10	1.20
10	3.30	2.10	.50	1.70	1.00	1.20	26	2.30	1.40	1.30	(a)	1.00	1.30
11	3.20	1.90	.50	1.60	1.10	1.10	27	2.40	1.30	1.20	(a)	1.00	1.30
12	3.20	1.80	.50	1.40	1.00	1.00	28	2.40	1.30	1.20	(a)	1.00	1.30
13	3.60	1.70	.50	1.10	1.60	1.00	29	2.30	1.20	1.10	1.00	1.00	1.30
14	9.00	1.60	.60	1.10	1.50	1.00	30	2.90	1.20	1.10	1.10	1.00	1.30
15	6.40	1.80	1.00	1.00	1.30	1.00	31	2.80	1.10	.....	1.00	.....	1.20
16	4.60	4.10	2.00	1.00	1.30	1.00							

[a] Observer died on October 17. New observer employed October 29.

Rating table for Etowah River at Rome, Ga., from July 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	900	1.8	1,598	3.2	2,772	5.8	6,180
.6	944	1.9	1,665	3.4	3,010	6.0	6,470
.7	989	2.0	1,733	3.6	3,250	6.2	6,770
.8	1,035	2.1	1,801	3.8	3,490	6.4	7,070
.9	1,082	2.2	1,869	4.0	3,730	6.6	7,375
1.0	1,130	2.3	1,937	4.2	3,975	6.8	7,685
1.1	1,179	2.4	2,005	4.4	4,224	7.0	8,000
1.2	1,230	2.5	2,077	4.6	4,478	7.5	8,800
1.3	1,285	2.6	2,155	4.8	4,741	8.0	9,600
1.4	1,344	2.7	2,241	5.0	5,020	8.5	10,400
1.5	1,405	2.8	2,335	5.2	5,310	9.0	11,200
1.6	1,468	2.9	2,437	5.4	5,600		
1.7	1,532	3.0	2,546	5.6	5,890		

Estimated monthly discharge of Etowah River at Rome, Ga., for 1903.

[Drainage area, 1,854 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July	11,200	1,937	3,246	1.75	2.02
August	3,852	1,179	2,001	1.08	1.25
September	1,733	900	1,206	.65	.73
October 1–17 and 29–31 [a]			1,162	.63	.47
November	2,335	1,130	1,359	.73	.81
December	1,285	1,130	1,168	.63	.73

[a] Observer died October 17. New observer employed October 29.

ETOWAH RIVER AT CANTON, GA.

This station was established in 1892 by the United States Weather Bureau. Measurements were begun in 1896 by United States Geological Survey. It is located at the wagon bridge in Canton, Ga., one-half mile above the mouth of Canton Creek and 1,000 feet upstream from the Atlanta, Knoxville and Northern Railroad station. The gage is a heavy vertical timber, bolted to the edge of the left-bank pier, on the upstream side. The footmarks are numbered with brass

figures. The gage is read once each day by J. M. McAfee who is paid by the United States Weather Bureau for six months of the year. Discharge measurements are made from the upstream side of the iron highway bridge, which is about 25 feet above low water, and to which the gage is attached. The initial point for soundings is the river side of the right-bank pier at the end of the main span. The channel is straight for 1,000 feet above and 500 feet below the bridge. The current is affected by a fish-trap dam about 1 foot high, which was constructed in 1902, and which has since caused some trouble by being occasionally washed away and built up again. Up to 3 feet gage height the river is only 116 feet wide and flows between the piers on its lower banks. Up to about 14 feet it is confined between its upper banks, which are the abutments at the outer end of the approaches. Above this point it begins to overflow the bottom lands. The bed is fairly constant.

Bench mark No. 1 is a cut on a silver maple tree on the east side of the road, 20 feet from the end of the bridge on the south or left bank of the river; its elevation is 20.36 feet above the zero of the gage. Bench mark No. 2 is a cut on a persimmon tree 4 feet from the upper side of the bridge and 10 feet toward the river from the south end of the bridge; its elevation is 16.88 feet above the zero of the gage. Bench mark No. 3 is the center of the head of a large wire nail, driven horizontally in the side toward the river of a walnut tree on the east side of the road, 25 feet north of the north end of the bridge; its elevation is 18.52 feet above the zero of the gage. Bench mark No. 4 is the top of the iron bar on the top of the left-bank pier at the end of the center span of the bridge; its elevation is 23.39 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Etowah River at Canton, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 28	M. R. Hall	1.07	922
March 27	Olin P. Hall	2.50	2,562
April 27	E. C. Murphy	1.80	1,873
June 25	M. R. Hall	.94	1,166
Do	do	.93	1,119
September 4	do	.51	570
Do	do	.51	575
October 10	O. P. Hall	.60	513

Mean daily gage height, in feet, of Etowah River at Canton, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	1.00	9.20	3.90	1.70	4.50	1.20	0.60	0.50	0.50	0.70	0.40
2	1.50	1.10	4.00	3.40	1.70	7.20	1.20	.80	.50	.50	.80	.40
3	1.00	1.60	2.00	2.90	1.60	4.70	1.10	1.10	.50	.50	1.00	.40
4	1.00	3.20	2.50	2.80	1.80	4.00	1.70	.70	.50	.50	1.00	.40
5	1.00	4.00	2.40	2.50	1.60	10.80	1.10	.70	.60	.50	1.50	.40
6	.80	2.00	2.90	2.30	1.40	7.50	1.00	.70	.60	.50	1.00	.40
7	.80	2.60	2.80	2.20	1.40	6.00	1.00	.70	.50	.50	.70	.40
8	.80	8.00	2.50	3.40	1.40	2.50	1.30	.60	.50	.50	.50	.40
9	.80	4.20	2.60	3.40	1.40	2.50	1.20	.60	.50	.90	.50	.40
10	.70	2.50	3.50	2.50	1.30	2.60	1.20	.60	.50	.60	.50	.40
11	2.80	7.00	11.00	2.20	1.30	2.50	1.20	.60	.40	.60	.50	.40
12	2.00	6.20	5.50	2.20	1.30	2.00	1.20	.70	.40	.60	.50	.40
13	1.80	3.10	3.50	5.20	1.30	1.60	5.30	.70	.40	.60	.50	.50
14	1.80	2.10	2.90	6.00	1.30	1.50	2.70	.70	.40	.60	.50	.50
15	1.60	2.80	2.50	3.20	1.20	1.30	2.00	2.50	1.00	.60	.50	.40
16	1.60	9.90	2.30	2.50	1.20	1.20	2.00	1.00	1.90	.60	.50	.40
17	1.40	17.70	2.20	2.40	1.10	1.20	2.00	1.00	.80	.80	.50	.40
18	1.40	5.10	2.00	2.30	1.10	1.20	1.90	2.20	.70	1.00	.80	.40
19	1.30	3.20	1.90	2.10	1.10	1.20	1.70	1.00	.50	.80	.60	.40
20	1.30	2.50	1.80	2.10	1.10	1.10	1.60	.90	.50	.80	.60	.50
21	1.30	2.40	5.50	2.20	1.10	1.10	1.60	.80	.50	.70	.50	.40
22	1.80	2.10	3.30	2.10	1.10	1.00	1.40	.80	.50	.70	.50	.40
23	1.60	2.00	13.00	2.00	1.00	1.00	1.20	.70	.50	.60	.50	.40
24	1.40	1.70	6.70	1.80	.90	1.00	1.00	.60	.50	.60	.50	.40
25	1.20	1.50	5.50	1.70	.90	1.00	.90	.50	.50	.60	.50	.60
26	1.20	1.60	3.00	2.30	.90	1.00	.80	.50	.50	.60	.50	.50
27	1.20	1.50	2.60	1.80	.90	1.10	.70	.50	.50	.70	.50	.50
28	1.20	15.00	2.40	1.70	.90	3.00	.70	.50	.50	.70	.50	.60
29	1.20	.....	2.90	1.70	.90	1.70	.70	.50	.50	.70	.40	.60
30	1.20	.....	12.20	1.70	1.80	1.50	.60	.50	.50	.70	.40	.50
31	1.20	.....	5.50	.....	2.60	.....	.60	.50	.....	.70	.....	.50

Rating table for Etowah River at Canton, Ga., from January 1 to August 15, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	800	2.6	2,620	8.0	7,130	14.0	12,110
.7	900	2.8	2,800	8.5	7,545	14.5	12,525
.8	1,000	3.0	2,980	9.0	7,960	15.0	12,940
.9	1,090	3.5	3,395	9.5	8,375	15.5	13,355
1.0	1,180	4.0	3,810	10.0	8,790	16.0	13,770
1.2	1,360	4.5	4,225	10.5	9,205	16.5	14,185
1.4	1,540	5.0	4,640	11.0	9,620	17.0	14,600
1.6	1,720	5.5	5,055	11.5	10,035	17.5	15,015
1.8	1,900	6.0	5,470	12.0	10,450	18.0	15,430
2.0	2,080	6.5	5,885	12.5	10,865		
2.2	2,260	7.0	6,300	13.0	11,280		
2.4	2,440	7.5	6,715	13.5	11,695		

Rating table for Etowah River at Canton, Ga., from August 16 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	430	0.9	780	1.4	1,220	1.9	1,670
.5	500	1.0	860	1.5	1,310	2.0	1,760
.6	570	1.1	950	1.6	1,400	2.1	1,850
.7	640	1.2	1,040	1.7	1,490	2.2	1,940
.8	710	1.3	1,130	1.8	1,580	2.3	2,030

Estimated monthly discharge of Etowah River at Canton, Ga., for 1903.

[Drainage area, 604 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,800	900	2,136	3.54	4.08
February	15,181	1,180	3,934	6.52	6.79
March	11,280	1,900	4,004	6.63	7.64
April	5,470	1,810	2,618	4.34	4.84
May	2,620	1,090	1,450	2.40	2.77
June	9,454	1,180	2,640	4.37	4.88
July	4,889	800	1,544	2.56	2.95
August	2,530	500	856	1.42	1.64
September	1,670	430	558	.92	1.03
October	860	500	598	.99	1.14
November	1,310	430	586	.97	1.08
December	570	430	459	.76	.88
The year	15,181	430	1,782	2.95	39.72

COOSAWATTEE RIVER AT CARTERS, GA.

This river is formed by the junction of Ellijay and Cartecay rivers at Ellijay, Ga., and flows in a southwesterly direction, joining the Conasauga to form the Oostanaula. Its drainage area is for the most part mountainous and covered with forest growth. This station was established August 15, 1896, by M. R. Hall, at the iron highway bridge at Carters, Murray County, Ga., about 20 miles northeast of Calhoun, the most convenient railroad station. Carters is at the head of navigation, small boats running to Rome, Ga., and the Coosa

River below. It is at the foot of the great shoals made by this stream in cutting through the Cohutta Mountains. The chain gage is fastened to the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 37.08 feet. The observer was H. S. Weems, a merchant at Carters, Ga., until the end of 1903, when he was succeeded by R. P. Messer. Discharge measurements are made from the single-span highway bridge and its approaches. The initial point for soundings is land side of the pier on the right bank. The channel is curved for 1,000 feet above and 500 feet below the station. The current is swift and broken. Both banks are high, but overflow at flood stages. The bed of the stream is of gravel, and is not liable to change. The bench mark is the top of the cylindrical iron pier at the right bank, downstream side. Its elevation is 30.35 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Coosawattee River at Carters, Ga., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 18	O. P. Hall	3.56	1,588
July 22	do	2.35	963
September 8	M. R. Hall	1.22	456
Do	O. P. Hall	1.22	444
October 16	do	1.07	374
December 31	do	1.26	416

Mean daily gage height, in feet, of Coosawattee River at Carters, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.70	2.00	9.20	6.00	3.40	4.50	2.60	2.20	1.30	1.00	1.20	1.10
2	2.00	2.50	5.40	5.20	3.20	5.00	2.50	2.30	1.20	1.00	1.20	1.10
3	2.50	3.00	4.60	4.90	3.20	5.20	2.40	2.40	1.20	1.00	1.40	1.20
4	2.00	10.00	4.10	5.00	3.10	5.00	2.30	2.50	1.20	1.00	1.30	1.20
5	1.60	9.00	4.10	4.40	3.00	6.80	2.30	2.40	1.20	1.00	1.20	1.20
6	1.60	7.00	5.00	4.20	2.80	5.50	2.20	2.30	1.30	.90	1.20	1.10
7	1.50	8.00	3.70	4.10	2.80	4.20	2.10	2.20	1.30	.90	1.10	1.05
8	1.40	7.00	5.90	8.00	2.70	3.50	2.00	2.10	1.20	2.00	1.10	1.05
9	1.40	6.00	4.60	4.10	2.70	3.60	2.20	2.30	1.20	1.40	1.05	1.10
10	1.20	6.00	5.10	4.20	2.70	3.00	2.30	2.40	1.15	1.20	1.05	1.10
11	3.30	9.00	8.90	4.00	2.60	4.70	2.50	2.30	1.10	1.00	1.20	1.10
12	2.70	6.50	4.80	3.80	2.60	4.20	3.00	2.20	1.05	1.05	1.30	1.20
13	2.40	4.50	4.30	10.00	2.50	3.50	9.00	2.10	1.05	1.00	1.10	1.40
14	2.10	4.00	4.20	5.40	2.50	3.40	6.00	2.10	1.10	1.00	1.10	1.30
15	2.00	4.00	4.00	4.80	2.40	3.00	4.20	2.00	1.20	1.00	1.10	1.30
16	2.00	10.50	3.80	4.40	2.50	2.80	3.80	2.20	1.60	1.05	1.20	1.20

Mean daily gage height, in feet, of Coosawattee River, etc.—**Continued.**

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	1.90	9.00	3.70	4.10	2.50	2.60	3.50	2.10	1.40	1.60	2.80	1.30
18	2.00	6.00	3.40	3.90	2.50	2.50	3.00	2.00	1.30	1.30	2.60	1.30
19	1.90	4.20	3.40	4.00	2.40	2.40	2.80	1.90	1.20	1.20	2.40	1.30
20	1.80	4.00	3.30	4.00	2.40	2.20	2.40	1.80	1.10	1.20	2.00	1.30
21	1.80	3.50	4.30	3.90	2.60	2.20	2.30	1.70	1.10	1.10	1.90	1.30
22	1.70	3.30	6.10	3.90	2.40	2.00	2.20	1.60	1.10	1.05	1.70	1.10
23	1.70	3.20	18.20	3.80	2.40	2.10	2.10	1.50	1.05	1.00	1.40	1.10
24	1.60	3.10	8.10	3.80	2.50	2.20	2.20	1.40	1.10	1.00	1.30	1.30
25	1.60	3.00	5.20	3.70	2.60	3.00	2.10	1.40	1.10	1.05	1.20	1.30
26	1.50	2.90	4.60	3.70	2.60	3.50	2.00	1.30	1.05	1.10	1.20	1.70
27	1.50	3.40	4.20	3.60	2.40	4.00	2.00	1.30	1.05	1.10	1.20	1.40
28	1.50	21.50	4.40	3.50	2.30	3.00	2.20	1.20	1.05	1.00	1.30	1.30
29	2.50	.....	6.40	3.60	3.00	3.00	2.10	1.20	1.05	1.00	1.20	1.10
30	2.20	.....	21.00	3.50	3.50	2.90	2.20	1.20	1.05	1.10	1.10	1.10
31	2.00	.....	7.80	.....	5.00	.....	2.40	1.30	.....	1.20	.....	1.10

Rating table for Coosawattee River at Carters, Ga., 1902–3.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	280	3.8	1,750	6.8	3,846	12.0	7,590
1.0	345	4.0	1,875	7.0	3,990	13.0	8,310
1.2	420	4.2	2,010	7.2	4,134	14.0	9,030
1.4	495	4.4	2,145	7.4	4,278	15.0	9,750
1.6	575	4.6	2,280	7.6	4,422	16.0	10,470
1.8	670	4.8	2,415	7.8	4,566	17.0	11,190
2.0	765	5.0	2,550	8.0	4,710	18.0	11,910
2.2	865	5.2	2,694	8.2	4,854	19.0	12,630
2.4	970	5.4	2,838	8.4	4,998	20.0	13,350
2.6	1,075	5.6	2,982	8.6	5,142	21.0	14,070
2.8	1,180	5.8	3,126	8.8	5,286	22.0	14,790
3.0	1,290	6.0	3,270	9.0	5,430	23.0	15,510
3.2	1,400	6.2	3,414	9.5	5,790		
3.4	1,510	6.4	3,558	10.0	6,150		
3.6	1,625	6.6	3,702	11.0	6,870		

Estimated monthly discharge of Coosawattee River at Carters, Ga., for 1903.

[Drainage area, 531 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,455	420	721	1.36	1.57
February	14,430	765	3,294	6.20	6.46
March	14,070	1,455	3,295	6.20	7.15
April	6,150	1,565	2,244	4.23	4.72
May	2,550	917	1,172	2.21	2.55
June	3,846	765	1,631	3.07	3.43
July	5,430	765	1,233	2.32	2.67
August	1,022	420	729	1.37	1.58
September	575	364	408	.77	.86
October	765	310	389	.73	.84
November	1,180	364	512	.96	1.07
December	622	364	421	.79	.91
The year	14,430	310	1,337	2.52	33.81

BLACK WARRIOR RIVER AT TUSCALOOSA, ALA.

A continuous record of gage heights at Tuscaloosa since 1889 has been kept by the United States Engineer Corps. During 1895 and 1896 a number of discharge measurements were also made, from which a rating table was obtained, and since that time measurements of flow have been made by the United States Geological Survey. The station is located about one-fourth of a mile above Mobile and Ohio Railroad bridge. There are three locks and dams within about 3 miles above the station.

The gage is located about three-fourths of a mile from the business center of Tuscaloosa, Ala. It is reached by passing down Bridge street to the river, thence down the east bank 1,800 feet. There is also a vertical iron gage on the downstream side of the second pier from the left bank of the highway bridge, from which the discharge measurements are made. Discharge measurements are made from the iron highway bridge above the gage. The initial point for soundings is the end of the iron bridge on the left bank, downstream side. The channel is straight for 15,000 feet above and below the station; its width at low water is 280 feet, and at high stages 625 feet. The current is sluggish at low stages. Both banks are high and steep and overflow only at extreme stages. The greater part of the bed is of rock and is permanent. There is but one channel, broken by the three bridge piers.

Bench mark No. 1 is on a willow tree 10 feet west of the gage; its elevation is 10.54 feet above the zero of the gage and 97.34 feet above the Mobile datum. Bench mark No. 2 is on a small hackberry tree 30 feet south of the upper end of the gage; its elevation is 52.06 feet above the zero of the gage and 139.36 feet above the Mobile datum. Daily gage heights are furnished to the Geological Survey by R. C. McCalla, United States assistant engineer.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Black Warrior River at Tuscaloosa, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 20	J. M. Giles	5.45	862
July 21	do	5.44	719

Mean daily gage height, in feet, of Black Warrior River at Tuscaloosa, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.20	13.35	54.30	16.70	8.50	9.60	6.43	6.95	5.10	3.98	5.03	4.71
2	13.75	12.55	52.41	16.65	8.15	12.50	5.90	7.40	5.15	3.95	5.17	4.72
3	16.53	13.75	47.25	15.30	7.90	14.21	5.65	8.55	5.00	3.80	5.68	4.78
4	23.50	18.55	41.42	14.12	7.75	12.35	5.44	7.65	4.91	3.75	5.55	4.84
5	22.52	35.00	36.90	13.10	7.45	12.40	5.80	6.95	4.80	3.61	5.21	4.85
6	19.81	37.85	33.11	12.30	7.15	13.35	6.35	6.50	4.73	3.98	5.04	4.87
7	17.10	36.00	37.82	11.50	6.92	16.83	6.15	6.80	4.55	4.20	4.98	4.88
8	15.11	56.35	36.50	11.15	6.89	16.50	5.90	6.72	4.45	4.70	4.90	4.88
9	13.31	55.85	39.15	12.30	7.00	12.20	5.75	6.55	4.40	4.75	4.88	4.88
10	12.10	51.50	39.20	22.35	6.90	10.50	6.50	6.10	4.42	4.90	4.84	4.89
11	12.53	52.00	37.75	20.10	6.75	10.85	6.25	6.35	4.31	4.97	4.80	4.90
12	23.95	53.75	35.12	16.50	7.05	11.00	6.35	6.15	4.25	5.10	4.87	4.92
13	28.41	51.10	33.80	14.35	8.65	10.35	6.52	6.10	4.21	5.15	4.91	4.87
14	25.75	46.15	36.15	21.20	14.35	9.45	6.70	6.00	4.19	4.95	4.87	4.85
15	21.90	41.11	36.00	32.12	36.85	8.30	6.55	5.95	4.13	4.96	4.92	4.87
16	19.01	40.50	33.84	28.20	43.40	7.65	6.25	6.25	4.10	4.93	4.97	4.86
17	16.11	56.65	31.12	23.40	43.10	7.08	5.90	6.60	4.00	4.98	4.98	4.86
18	14.50	56.75	28.65	18.35	37.10	6.70	5.81	6.85	4.08	5.01	4.91	4.84
19	12.51	52.95	26.15	16.00	30.65	6.45	5.70	7.82	4.08	4.99	4.90	4.80
20	11.85	46.75	23.50	14.50	25.80	6.20	5.45	7.60	4.03	4.98	4.88	4.92
21	11.05	41.30	20.85	14.90	21.55	6.23	5.10	6.91	3.98	4.90	4.86	5.06
22	10.84	36.50	18.80	17.95	17.60	7.20	5.05	6.55	3.94	4.85	4.80	5.28
23	9.98	32.30	17.55	15.90	13.85	6.95	4.75	6.10	3.90	4.76	4.78	5.15
24	9.51	28.85	16.15	13.81	11.10	6.75	4.70	5.65	3.89	4.65	4.75	5.48
25	8.65	26.10	14.80	12.30	9.80	6.83	4.83	5.45	3.86	4.60	4.73	5.60
26	8.25	23.95	13.48	11.30	9.00	7.80	4.90	5.25	3.80	4.50	4.75	5.51
27	8.05	22.00	12.40	10.50	8.35	7.52	4.80	5.15	3.75	4.50	4.74	5.39
28	9.85	45.42	11.85	10.00	7.80	7.15	4.65	5.05	3.70	4.60	4.75	5.15
29	12.35	.....	11.62	9.45	7.45	6.91	7.85	4.95	3.81	4.68	4.73	5.12
30	14.72	.....	11.78	8.95	7.15	6.55	4.75	5.35	3.95	4.76	4.70	5.09
31	14.55	.....	13.50	.....	7.32	.....	6.50	5.15	.....	4.81	.....	5.07

BLACK WARRIOR RIVER NEAR CORDOVA, ALA.

This station is located at the Kansas City, Memphis and Birmingham Railroad bridge, which crosses the river below the junction of the Mulberry and Spipsey forks, and about three-fourths of a mile from Cordova, Ala. The gage was established by the United States Weather Bureau, but observations were discontinued by that Bureau sometime ago. From 12 to 55 feet the gage is a vertical timber bolted to the inside of the bridge pier on the left bank of the river. Below 12 feet the gage was sloping, but it was out of position and could not be used when the station was established by the Geological Survey on May 21, 1900, so a short new section was put in at that time. This section is a 2 by 10 inch plank, graduated to feet and tenths, from − 1.5 to + 12.5 feet, and spiked to a willow tree on the right bank of the river about 200 feet below the bridge.

Measurements are made from the downstream side of the railroad bridge, which is a two-span, iron through bridge. The span across the river is 300 feet long. The span on the left bank is about 150 feet long. At low stages discharge measurements are made from a boat at a point some distance below the bridge. The channel is curved for 500 feet above and straight for 1,000 feet below the station. The right bank is a rock bluff and will not overflow. The left bank overflows only under the second span of the bridge. The bed of the stream is of rock and is permanent. The channel has a width of about 180 feet at low water and about 450 feet at high stages.

Bench mark No. 1 is the top of the fourth crossbeam from the initial point for soundings, on the downstream side. Its elevation is 60.09 feet above the zero of the gage. Bench mark No. 2 is a copper plug in the solid rock about 110 feet above the bridge, 50 feet from the initial point for soundings. Its elevation is 32.12 feet above the zero of the gage. The top of the pier at the left bank is 55.10 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Black Warrior River near Cordova, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	J. M. Giles	13.90	19,252
March 13	do	6.90	9,486
May 19	do	4.84	5,159
June 15	do	.50	1,036
July 17	do	— .30	306
August 27	do	— .48	205
August 29	do	— .65	142
September 25	do	— .90	78

Mean daily gage height, in feet, of Black Warrior River near Cordova, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.30	2.30	27.60	3.70	0.80	2.80	—0.10	0.00	—0.70	—0.90	—0.40	—0.50
2	2.40	3.40	21.60	3.30	.70	3.80	— .20	.00	— .70	— .90	— .40	— .50
3	7.80	8.30	13.50	2.70	.70	2.50	— .20	.50	— .70	— .90	— .40	— .60
4	8.20	9.00	7.20	2.30	.70	1.60	— .30	.30	— .70	— .90	— .40	— .60
5	6.00	15.80	6.20	2.30	.70	1.80	.00	.10	— .70	— .90	— .40	— .60
6	4.90	10.00	13.70	2.80	.60	4.70	— .10	— .10	— .70	— .90	— .50	— .60
7	3.80	8.70	11.40	1.90	.60	3.80	— .20	— .20	— .70	— .90	— .50	— .60
8	3.00	26.10	10.10	2.00	.50	2.60	.00	— .20	— .70	— .50	— .60	— .60
9	2.60	25.40	15.70	10.00	.50	2.00	— .10	— .20	— .80	— .40	— .60	— .60
10	2.40	16.10	11.90	5.40	.50	2.40	— .20	— .30	— .80	— .30	— .60	— .60
11	3.90	21.20	10.20	4.00	.50	2.00	.00	— .30	— .80	— .30	— .60	— .60
12	10.00	25.30	8.20	3.40	.50	2.00	— .10	— .30	— .80	— .30	— .40	— .60
13	7.80	18.00	6.70	5.50	.80	1.40	— .10	— .30	— .80	— .40	— .40	— .60
14	5.60	9.00	8.60	12.20	6.60	.90	— .20	— .40	— .80	— .50	— .50	— .60
15	4.50	11.10	8.60	8.00	20.10	.60	— .30	— .40	— .80	— .60	— .60	— .50
16	3.60	14.30	6.90	5.80	19.40	.50	— .30	— .30	— .80	— .60	— .60	— .50
17	2.50	29.50	5.90	4.60	11.20	.30	— .30	— .30	— .80	— .70	— .60	— .50
18	2.80	27.30	5.30	3.90	6.80	.20	— .40	— .40	— .90	— .70	— .60	— .50
19	2.40	17.80	4.50	2.90	4.90	.10	— .40	— .40	— .90	— .70	— .60	— .50
20	1.80	10.50	4.00	3.20	3.80	.00	— .40	— .50	— .90	— .70	— .50	— .50
21	1.70	7.90	3.40	6.80	2.80	.00	— .40	— .50	— .90	— .70	— .50	— .50
22	1.80	5.40	3.00	4.50	2.40	.00	— .50	— .60	— .90	— .70	— .50	.50
23	1.60	5.00	3.00	3.40	1.80	.20	— .50	— .60	— .90	— .70	— .50	.10
24	1.40	4.50	2.90	3.00	1.50	.70	— .50	— .60	— .90	— .70	— .50	.10
25	1.40	3.70	2.70	2.60	1.30	.50	— .50	— .60	— .90	— .70	— .50	— .30
26	1.40	3.30	2.30	2.00	1.00	.40	— .50	— .60	— .90	— .70	— .50	— .40
27	1.30	3.00	2.00	1.70	.80	.30	— .60	— .60	— .90	— .70	— .50	— .30
28	1.90	21.90	1.80	1.50	.60	.20	— .60	— .60	— .90	— .70	— .50	— .30
29	3.50	.....	1.70	1.40	.50	.20	— .60	— .70	— .90	— .80	— .50	— .40
30	3.40	.....	2.30	1.00	.40	.10	— .60	— .70	— .90	— .80	— .50	— .40
31	2.80	.....	2.90	.....	.80	.....	— .20	— .70	.....	— .50	.....	— .40

Rating table for Black Warrior River near Cordova, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−.9	78	0.4	800	1.7	1,840	3.0	3,300
−.8	100	.5	875	1.8	1,940	3.1	3,430
−.7	126	.6	950	1.9	2,040	3.2	3,560
−.6	159	.7	1,025	2.0	2,140	3.3	3,695
−.5	198	.8	1,100	2.1	2,250	3.4	3,830
−.4	247	.9	1,175	2.2	2,360	3.5	3,970
−.3	307	1.0	1,250	2.3	2,475	3.6	4,110
−.2	374	1.1	1,325	2.4	2,590	3.7	4,255
−.1	442	1.2	1,400	2.5	2,705	3.8	4,400
+.0	510	1.3	1,480	2.6	2,820	3.9	4,550
.1	580	1.4	1,560	2.7	2,935	4.0	4,700
.2	650	1.5	1,650	2.8	3,050		
.3	725	1.6	1,740	2.9	3,175		

Above 3.8 feet gage height, differences 150 per tenth.

Estimated monthly discharge of Black Warrior River near Cordova, Ala., for 1903.

[Drainage area, 1,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	13,700	1,480	4,306	2.27	2.62
February	42,950	2,475	17,941	9.44	9.83
March	40,100	1,840	10,203	5.37	6.19
April	17,000	1,250	4,773	2.51	2.80
May	28,850	800	4,176	2.20	2.54
June	5,750	510	1,661	.87	.97
July	510	159	317	.17	.20
August	875	126	306	.16	.18
September	126	78	97	.051	.057
October	307	78	148	.078	.090
November	247	159	198	.10	.11
December	875	159	252	.13	.15
The year	42,950	78	3,698	1.95	25.74

LOCUST FORK OF BLACK WARRIOR RIVER AT PALOS, ALA.

Locust Fork of Black Warrior River rises in Blount County, Ala., and, flowing in a southwesterly course, enters Black Warrior River a short distance above Wilmington, Ala. Its drainage basin is hilly, and only a small part of its area is in cultivation. Palos station was established November 26, 1901, by R. C. McCalla, United States assistant engineer, who furnishes the daily gage heights to the Geological Survey. It is maintained by the United States Engineer Corps. The gage is a 4 by 8 inch timber, on the right bank of the river, just below the Kansas City, Memphis and Birmingham Railroad bridge. One section follows the slope of the bank from low water to a tree on top of the bank, and from there up a vertical section is fastened to the tree. The slope is 17 feet in elevation, measured vertically, and the vertical section of the rod is 15 feet. The rod is graduated to feet and tenths, with copper figures at the 5-foot points and round-head tacks at intermediate foot marks. The total height is 32 feet. The plane of reference (about 251.71 feet above Mobile datum) is supposed to be extreme low water. High water, April, 1900, was about 37 feet above the plane of reference.

Measurements are made from the Drennan bridge, which is about a quarter of a mile below the Kansas City, Memphis and Birmingham Railroad bridge. The Drennan bridge is the property of the Drennan Coal Mining Company. It is a mining railroad bridge, having width for a double-track tramway of 3 feet gage. One track is laid and in operation. The bridge has two iron spans of 100 feet each and trestle approaches at both ends.

Low-water measurements are made by wading at a shoal one-third mile below the bridge. The initial point for soundings is the left-bank end of the iron bridge on the downstream side. The channel is curved for 1,500 feet above the station and is straight for 3,000 feet below. At low water the channel is 180 feet wide. There is a ledge of rock about 200 feet below the station with about 3 feet fall. Both banks are high and wooded. The right bank overflows at flood stages, but only under the approach to the bridge. The bed is mainly of rock and is permanent.

Bench mark No. 1 is the top of the crossbeam at a point 80 feet from the initial point for soundings on the downstream side. Its elevation is 46.70 feet above the surface of the water, less the reading of the gage. It was established by measuring down to water surface with a steel tape. Bench mark No. 2 is a copper plug in a water-oak tree on the right hand, 20 feet downstream from the gage. Its elevation is 21.68 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Locust Fork of Black Warrior River at Palos, Ala., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 7	J. M. Giles	4.75	7,450
March 14	do	3.55	5,342
May 20	do	1.75	2,148
June 16	do	.62	431
Do	do	.62	404
July 18	do	.40	228
August 28	do	.13	84
Do	do	.13	93
September 26	do	.02	47

Mean daily gage height, in feet, of Locust Fork of Black Warrior River at Palos, Ala., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.20	1.10	17.00	2.60	0.90	1.20	0.40	0.70	0.40	0.00	0.20	0.10
2	1.30	1.10	7.40	2.20	.90	2.10	.40	1.00	.30	.00	.20	.10
3	1.50	1.60	4.20	1.90	.80	1.40	.40	.70	.20	.00	.20	.10
4	1.50	8.30	3.20	1.70	.80	1.20	.80	.90	.10	.00	.10	.10
5	1.60	7.60	2.80	1.60	.80	1.10	.80	.80	.10	.00	.10	.10
6	1.50	4.80	4.60	1.50	.70	1.60	.70	.60	.10	.00	.10	.10
7	1.40	4.30	5.20	1.40	.70	1.40	.60	.50	.10	.00	.10	.10
8	1.30	18.10	3.80	1.50	.70	1.20	.60	.40	.10	.00	.00	.10
9	1.20	12.20	4.30	4.00	.60	1.10	.50	.40	.00	.40	.00	.10
10	1.00	6.40	3.50	3.70	.60	1.10	.50	.40	.00	.30	.00	.10
11	1.50	12.60	3.80	2.20	.60	1.50	.50	.40	.00	.20	.20	.10
12	3.20	12.50	2.80	1.80	.60	1.10	.40	.30	.00	.20	.30	.10
13	2.70	6.60	2.50	1.80	.70	1.00	.50	.30	.00	.10	.30	.10
14	2.00	4.40	3.60	10.20	1.00	.80	.80	.30	.00	.10	.30	.10
15	1.70	4.20	3.70	7.20	5.80	.70	.90	.60	.00	.00	.20	.10
16	1.60	7.50	3.10	3.80	11.90	.60	.70	.80	.00	.00	.10	.10
17	1.40	23.00	2.60	2.60	5.70	.60	.50	.70	.00	.00	.10	.10
18	1.40	18.10	2.30	2.10	3.00	.60	.40	.70	.00	.00	.10	.10
19	1.20	7.40	2.00	1.90	2.10	.60	.30	.70	.00	.00	.10	.10
20	1.10	4.20	1.80	1.90	1.80	.50	.30	.60	.00	.00	.10	.20
21	1.10	3.10	1.70	2.50	1.50	.50	.20	.60	.00	.00	.10	.10
22	1.00	2.60	1.70	2.00	1.30	.40	.20	.60	.00	.00	.10	.10
23	1.00	2.20	1.80	1.70	1.20	.50	.20	.40	.00	.00	.10	.10
24	.10	2.00	1.70	1.50	1.10	.40	.20	.30	.00	.00	.10	.10
25	.90	1.80	1.60	1.40	1.00	.40	.20	.30	.00	.00	.10	.10
26	.90	1.70	1.50	1.30	.90	.40	.20	.20	.00	.00	.10	.20
27	.80	1.60	1.40	1.20	.80	.50	.20	.20	.00	.00	.10	.20
28	.80	20.00	1.30	1.10	.70	.50	.10	.10	.00	.00	.10	.20
29	1.20	.....	1.30	1.00	.70	.50	.10	.10	.00	.00	.10	.20
30	1.30	.....	1.40	1.00	.80	.50	.10	.10	.00	.00	.10	.20
31	1.20	.....	2.70	.....	.90	.....	.30	.10	.....	.30	.....	.20

Rating table for Locust Fork of Black Warrior River at Palos, Ala., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	46	0.8	605	1.6	1,770	2.4	3,210
.1	77	.9	720	1.7	1,950	2.5	3,390
.2	115	1.0	845	1.8	2,130	2.6	3,570
.3	167	1.1	980	1.9	2,310	2.7	3,750
.4	230	1.2	1,120	2.0	2,490	2.8	3,930
.5	306	1.3	1,265	2.1	2,670	3.0	4,290
.6	398	1.4	1,420	2.2	2,850		
.7	500	1.5	1,590	2.3	3,030		

Tangent at 2 feet with difference of 180 per tenth thereafter.

Estimated monthly discharge of Locust Fork of Black Warrior River at Palos, Ala., for 1903.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,650	605	1,428	1.40	1.61
February	40,290	980	11,498	11.27	11.74
March	29,490	1,265	4,833	4.74	5.46
April	17,250	845	3,246	3.18	3.55
May	20,310	398	2,097	2.06	2.37
June	2,670	230	758	.74	.83
July	720	77	276	.27	.31
August	845	77	326	.32	.37
September	230	46	64	.06	.07
October	230	46	66	.06	.07
November	167	46	89	.09	.10
December	115	77	86	.08	.09
The year	40,290	46	2,064	2.02	26.57

TOMBIGBEE RIVER AT COLUMBUS, MISS.

The gage is located about 1,000 feet below the county highway bridge, 1 mile from the Southern Railway station at Columbus, Miss. A vertical 3 by 10 inch pine timber is fastened to the blue rock bluff on the left bank and is marked with brass figures and brass nails from −5 to +43 feet. Discharge measurements are made from the county highway bridge at the south end of Main street. The initial point for soundings is the end of the iron bridge on the right bank, downstream side. The channel is slightly curved for 500 feet above and 1,000 feet below the station. The current is sluggish at low stages and very swift above a gage height of 12 feet. The right bank is high and sel-

dom overflows. The left bank overflows from gage height 18 to 22 feet. The bed of the stream is of soft blue rock.

Bench mark No. 1 is the top of the downstream girder at a point 250 feet from the initial point for soundings. Its elevation is 39.88 feet above the zero of the gage. This point is on the movable portion of the drawbridge and may vary in elevation. Bench mark No. 2 is a copper plug in a tree at the southeast corner of First street and Second avenue. Its elevation is 17.94 feet above the zero of the gage. This tree has boards nailed to it, showing the names of the streets. Bench mark No. 3 is the top of the rail at the depot of the Southern Railway and is 55.2 feet above gage datum and 191 feet above mean sea level.

The observer, J. J. Richards, is paid by the United States Weather Bureau.

The width of the river at low water is 160 feet. The maximum recorded height of the river was on April 8, 1892, when the gage registered 42 feet. The lowest recorded height was on October 26, 1893, when the gage reading was —3.9 feet. The danger line is at 33 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tombigbee River at Columbus, Miss., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 9	J. M. Giles	15.50	26,452
March 12	do	17.30	29,015
May 18	do	12.50	17,804
July 16	do	— 1.70	1,340
July 17	do	1.80	1,278
September 22	do	— 3.70	252
September 25	do	— 3.70	263

Mean daily gage height, in feet, of Tombigbee River at Columbus, Miss., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.80	9.00	10.40	3.50	– 0.40	3.10	0.00	–2.20	–3.40	–3.70	–3.20	–3.00
2	8.40	8.20	10.80	3.40	– .60	2.90	– .80	–2.10	–3.40	–3.70	–2.80	–2.60
3	11.80	7.70	11.50	3.00	– .90	3.00	–1.30	–2.20	–3.50	–3.70	–2.00	–2.60
4	12.20	8.50	11.70	2.50	– 1.10	3.00	–1.40	–2.40	–3.50	–3.70	–1.80	–2.80
5	11.80	8.80	11.40	2.00	– 1.10	2.90	–1.60	–1.60	–3.50	–3.70	–1.70	–3.00
6	12.20	9.00	11.50	1.70	– 1.20	2.30	–1.70	–2.80	–3.60	–3.70	–1.60	–3.00
7	12.00	12.00	12.40	1.30	– 1.30	2.30	–2.00	–2.90	–3.60	–3.70	–1.40	–3.00
8	11.00	18.60	13.60	1.00	– 1.40	2.30	–1.80	–3.00	–3.60	–3.60	–1.40	–3.00
9	8.80	19.80	15.30	.80	– 1.40	2.10	–2.00	–2.40	–3.60	–3.70	–1.50	–3.00
10	8.50	20.50	16.00	1.60	– 1.40	1.90	–2.00	–2.30	–3.60	–3.70	-1.50	–3.00
11	8.90	22.30	17.00	2.60	– 1.40	1.30	–2.00	–1.50	–3.60	–3.70	–1.50	–3.00
12	9.50	23.90	17.30	2.40	– 1.10	1.20	–2.00	–1.00	–3.70	–3.60	–1.50	–2.90
13	9.80	23.80	17.50	2.20	1.00	.80	–2.10	–1.00	–3.70	–3.60	–1.40	–2.80
14	9.90	22.70	18.50	1.90	8.00	.10	–1.70	– .80	–3.70	–3.60	–2.30	–2.60
15	10.40	21.50	19.80	2.70	10.60	– .40	–1.80	–1.20	–3.70	–3.60	–2.60	–2.60
16	10.40	20.90	20.00	3.60	12.00	– .80	–1.90	–1.20	–3.70	–3.60	–3.00	–2.90

Mean daily gage height, in feet, of Tombigbee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	9.40	22.50	19.80	3.60	12.00	−1.00	−1.90	−1.50	−3.70	−3.50	−3.00	−3.00
18	7.60	23.00	19.20	3.30	12.50	−1.60	−2.10	−1.70	−3.70	−3.50	−3.20	−3.00
19	5.60	23.10	18.30	2.80	11.90	−1.80	−2.30	−1.90	−3.70	−3.60	−2.70	−2.80
20	4.60	23.60	16.70	2.20	10.10	−1.90	−2.40	−1.00	−3.70	−3.60	−2.70	−2.60
21	5.50	23.30	14.00	1.50	7.60	−1.90	−2.50	−1.70	−3.70	−3.50	−2.70	−2.50
22	3.20	21.70	12.10	1.00	5.70	−2.00	−2.60	−1.40	−3.70	−3.50	−2.70	−2.50
23	2.70	19.80	10.80	1.60	3.00	−2.00	−2.60	−2.00	−3.80	−3.50	−2.80	−2.60
24	2.30	17.00	9.80	2.00	1.20	−1.70	−3.00	−2.30	−3.80	−3.60	−2.80	−2.90
25	2.00	15.80	9.50	2.00	.40	−1.30	−3.00	−2.50	−3.70	−3.60	−2.60	−2.90
26	1.90	14.60	8.80	1.60	− .20	−1.60	−3.00	−2.60	−3.70	−3.50	−2.70	−2.70
27	1.90	8.70	6.90	1.40	− .60	.80	−3.00	−2.90	−3.70	−3.50	−2.70	−2.10
28	5.60	9.20	5.10	.60	− 1.00	1.90	−3.00	−2.90	−3.70	−3.50	−2.80	−1.70
29	7.60	.....	4.00	.10	− 1.00	1.50	−3.10	−3.00	−3.70	−3.50	−2.80	−1.60
30	8.00	.....	3.40	− .20	− 1.10	.80	−3.10	−3.10	−3.70	−3.60	−3.00	−1.60
31	8.80	.....	3.50	.....	.10	.....	−3.10	−3.30	.....	−3.50	.....	−1.80

Rating table for Tombigbee River at Columbus, Miss., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−3.8	220	−1.0	1,900	3.6	6,620	8.2	12,840
−3.7	260	− .8	2,060	3.8	6,860	8.4	13,140
−3.6	300	− .6	2,220	4.0	7,110	8.6	13,440
−3.5	340	− .4	2,400	4.2	7,360	8.8	13,740
−3.4	380	− .2	2,580	4.4	7,610	9.0	14,040
−3.3	425	.0	2,760	4.6	7,860	9.2	14,350
−3.2	470	+ .2	2,940	4.8	8,120	9.4	14,660
−3.1	520	.4	3,140	5.0	8,380	9.6	14,970
−3.0	570	.6	3,340	5.2	8,640	9.8	15,280
−2.9	620	.8	3,540	5.4	8,910	10.0	15,590
−2.8	675	1.0	3,740	5.6	9,180	10.2	15,900
−2.7	730	1.2	3,940	5.8	9,450	10.4	16,210
−2.6	785	1.4	4,160	6.0	9,720	10.6	16,530
−2.5	840	1.6	4,380	6.2	9,990	10.8	16,850
−2.4	895	1.8	4,600	6.4	10,260	11.0	17,170
−2.3	950	2.0	4,820	6.6	10,540	11.2	17,490
−2.2	1,010	2.2	5,040	6.8	10,820	11.4	17,810
−2.1	1,070	2.4	5,260	7.0	11,100	11.6	18,140
−2.0	1,135	2.6	5,480	7.2	11,380	11.8	18,470
−1.8	1,275	2.8	5,700	7.4	11,670	12.0	18,800
−1.6	1,420	3.0	5,920	7.6	11,960	12.1	18,970
−1.4	1,580	3.2	6,140	7.8	12,250		
−1.2	1,740	3.4	6,380	8.0	12,540		

Above 6 feet gage height 1902 and 1903 rating tables are the same. Above 13 feet gage height differences 170 per tenth.

Estimated monthly discharge of Tombigbee River at Columbus, Miss., for 1903.

[Drainage area, 4,440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	19,140	4,710	12,300	2.77	3.19
February	39,030	12,105	27,631	6.22	6.48
March	32,400	6,380	20,465	4.61	5.32
April	6,620	2,580	4,828	1.09	1.22
May	19,650	1,580	6,250	1.41	1.63
June	6,030	1,135	3,439	.77	.86
July	2,760	520	1,084	.24	.28
August	2,060	425	1,139	.26	.30
September	380	220	281	.06	.07
October	340	260	300	.07	.08
November	1,580	470	961	.22	.25
December	1,420	570	770	.17	.20
The year	39,030	220	6,621	1.49	19.88

MISCELLANEOUS MEASUREMENTS IN MOBILE RIVER DRAINAGE BASIN.

Little River.—At wagon bridge 3¼ miles west of Cedar Bluff, Ala., this stream was discharging 123 second-feet on July 2, 1903. The bench mark is the third crossbeam from left-bank end of bridge. Elevation is 27 feet; gage height, 1.60 feet.

Chattooga River.—At wagon bridge at Gaylesville, Ala., this stream was discharging 325 second-feet on July 2, 1903. The bench mark is top of plate on bottom of first vertical strut from left bank. Elevation, 28 feet; gage height, 2.05 feet.

Luxapelila Creek.—At Columbus city waterworks, Columbus, Miss., this stream was discharging 272 second-feet on July 16, 1903. The bench mark is top of upstream end of crossbeam 90 feet from right-bank end of bridge. Elevation, 26.45 feet above datum; gage height, 3 feet.

Discharge measurements of East Cahaba River in 1903.

Date.	Locality.	Discharge.
		Second-feet.
September 30	Deshazo's mill, near Bridgeton, Ala	30
Do	do	29
November 12	do	28
Do	½ mile above Deshazo's mill	21
Do	Pledger's mill	13.3
Do	3 miles southwest of Leeds	6.8

PEARL RIVER DRAINAGE BASIN.

Pearl River rises in the eastern part of Mississippi. It flows south into Lake Borgne, an arm of the Gulf of Mexico, forming part of the boundary between Louisiana and Mississippi. The United States Geological Survey maintains one station on this river. It is located at Jackson, Miss.

PEARL RIVER AT JACKSON, MISS.

This station was established June 24, 1901, by K. T. Thomas. It is located 2 miles from the Union station at Jackson, Miss., one-eighth mile above the Alabama and Vicksburg Railroad, and two blocks east from the end of the South State street car line. The chain gage is fastened to the downstream side of the bridge at a point 130 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 41.91 feet. The gage is read once each day by James Hurst. Discharge measurements are made from the single-span highway bridge and from an approach of 680 feet of iron trestle on the left bank. The initial point for soundings is the end of the bridge on the right bank. The channel makes a 90° curve about 200 feet above the bridge. It is nearly straight for about one-fourth mile below the bridge. The right bank is high and rocky and does not overflow. The left bank is of cleared ground and overflows at about 20 feet gage height. The width of the stream at low stages is about 130 feet and at flood stages about 900 feet. The bed is of sand and gravel and is shifting. The current velocity is moderate, but is not well distributed, and is broken by an old pier and some short piles under the bridge. At low stages the discharge can be measured by wading about one-fourth mile above the bridge. The bench mark is the downstream end of the top of the iron crossbeam, 120 feet from the right-bank end of the bridge. Its elevation is 39 feet above gage datum. The elevation of the bridge floor at the same point is 40.15 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Pearl River at Jackson, Miss., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 10	J. M. Giles	24.00	16,050
July 13	do	4.15	1,348
July 14	do	5.37	1,988
September 24	do	.80	128
Do	do	.78	142

Mean daily gage height, in feet, of Pearl River at Jackson, Miss., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.90	6.70	26.00	12.60	2.80	2.80	1.70	2.00	2.20	0.70	0.30	0.30
2	13.80	7.40	25.10	10.90	2.70	2.30	1.80	2.00	2.00	.70	.30	.30
3	14.90	12.20	24.20	9.80	2.60	2.20	1.80	1.80	1.90	.70	.30	.30
4	15.20	13.40	23.00	9.20	2.60	2.20	1.90	1.70	1.80	.70	.30	.30
5	15.80	14.60	22.40	8.50	2.50	2.10	2.00	1.50	1.60	.70	.30	.40
6	16.60	15.80	21.80	7.80	2.50	2.20	2.10	1.60	1.60	.70	.30	.50
7	16.00	19.00	21.60	7.10	2.40	2.20	2.20	2.50	1.50	.70	.30	.60
8	16.00	23.00	21.60	6.70	2.40	2.30	2.30	2.60	1.30	.60	.30	.80
9	15.90	23.40	23.50	6.10	2.50	3.50	2.40	2.80	1.20	.60	.30	.90
10	15.60	24.60	23.90	5.70	2.50	3.40	2.50	2.90	1.20	.60	.30	.90
11	15.60	27.50	24.70	5.20	2.40	2.50	2.70	3.50	1.10	.60	.30	1.00
12	15.40	30.40	24.90	5.00	2.40	2.40	2.80	4.40	1.10	.60	.30	1.00
13	14.00	32.50	25.20	5.80	2.50	2.30	2.70	4.50	1.00	.60	.30	1.00
14	14.60	33.70	25.40	4.60	2.60	2.30	5.30	4.60	1.00	.60	.30	1.00
15	13.80	33.50	25.70	4.40	2.80	2.40	4.60	4.60	1.00	.50	.30	1.20
16	13.40	33.20	25.90	4.30	3.00	2.50	4.30	4.50	1.00	.50	.30	1.20
17	13.10	33.10	25.90	4.50	3.10	2.30	3.80	4.60	.90	.50	.30	1.30
18	13.20	32.80	25.80	4.70	3.50	2.20	2.70	4.00	.90	.50	.30	1.30
19	13.10	32.30	25.30	4.60	4.00	2.10	2.50	4.60	.80	.50	.30	1.30
20	13:00	31.50	24.60	4.50	4.40	2.00	2.40	4.80	.80	.50	.30	1.30
21	12.50	30.90	23.70	4.30	4.50	1.90	2.20	5.10	.80	.60	.30	1.30
22	11.40	30.90	23.70	4.20	4.20	1.80	2.00	4.80	.80	.60	.30	1.30
23	10.40	30.10	23.40	4.00	3.90	1.70	1.90	4.60	.80	.60	.30	1.30
24	9.50	30.00	22.80	3.80	3.70	1.60	1.70	4.30	.80	.60	.30	1.40
25	8.40	29.80	21.90	3.60	3.50	1.70	1.60	4.10	.80	.50	.30	1.40
26	8.90	28.70	20.90	3.40	3.40	1.80	1.50	3.80	.80	.50	.30	1.40
27	7.80	27.60	19.60	3.20	3.30	1.80	1.50	3.40	.80	.50	.30	1.40
28	7.30	26.70	18.00	3.00	3.10	1.70	1.40	3.00	.80	.50	.30	1.40
29	6.80	.....	16.50	2.90	3.50	1.70	1.30	2.70	.80	.40	.30	1.40
30	6.50	.....	15.30	2.80	2.70	1.80	1.20	2.50	.80	.30	.30	1.30
31	6.60	.....	13.80	.....	2.50	.....	1.20	2.30	.....	.30	.30	1.30

Rating table for Pearl River at Jackson, Miss., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.3	98	2.2	467	4.1	1,300	6.1	2,450
.4	103	2.3	503	4.2	1,350	6.2	2,510
.5	109	2.4	540	4.3	1,400	6.3	2,570
.6	117	2.5	580	4.4	1,455	6.4	2,630
.7	126	2.6	620	4.5	1,510	6.5	2,695
.8	136	2.7	660	4.6	1,565	6.6	2,760
.9	148	2.8	700	4.7	1,620	6.7	2,825
1.0	162	2.9	740	4.8	1,675	6.8	2,890
1.1	177	3.0	785	4.9	1,730	6.9	2,955
1.2	194	3.1	830	5.0	1,790	7.0	3,020
1.3	214	3.2	875	5.1	1,850	7.2	3,160
1.4	235	3.3	920	5.2	1,910	7.4	3,300
1.5	257	3.4	965	5.3	1,970	7.6	3,440
1.6	280	3.5	1,010	5.4	2,030	7.8	3,585
1.7	305	3.6	1,055	5.6	2,150	8.0	3,735
1.8	333	3.7	1,100	5.7	2,210	8.1	3,810
1.9	365	3.8	1,150	5.8	2,270	16.0	9,735
2.0	398	3.9	1,200	5.9	2,330	16.1	9,815
2.1	432	4.0	1,250	6.0	2,390		

From gage height 8 feet to gage height 16 feet, differences 75 per tenth; above gage height 16 feet, differences 80 per tenth. Table determined by one flood measurement above gage height 6 feet.

Estimated monthly discharge of Pearl River at Jackson, Miss., for 1903.

Month.	Dicharge in second-feet.		
	Maximum.	Minimum.	Mean.
January	10,215	2,695	7,082
February	23,895	2,825	17,421
March	17,735	8,085	15,162
April	7,185	700	2,265
May	1,510	540	821
June	1,010	280	468
July	1,970	194	558
August	1,850	257	1,023
September	467	136	197
October	126	98	115
November	98	98	98
December	235	98	178
The year	23,895	98	3,782

EASTERN MISSISSIPPI RIVER DRAINAGE.

For convenience of classification the drainage areas of the tributaries from the east that contribute to the Mississippi River drainage have been grouped together. These tributaries vary widely in character, as regards both the types of the rivers and the topography of the areas which they drain. Those draining the comparatively low rolling country adjacent to the Valley of the Mississippi are as a rule sluggish streams, with few falls of importance, while the upper Ohio River and its numerous tributaries drain a country of high elevations, their upper courses being through narrow V-shaped valleys, with frequent falls and with high rocky banks. Owing to the steep slopes the run-off is rapid, causing sudden fluctuations in the streams and giving rise to the high floods and extreme low waters for which the Ohio basin is noted, and the influence of which is felt to a marked degree even in the flow of the Mississippi below Cairo.

In this report these drainage areas have been arranged geographically from north to south, and the Ohio River drainage has been divided into its smaller systems. The following are the systems from which the United States Geological Survey has obtained data during 1903: Those which enter the Mississippi above the mouth of the Oh o are Rum and St. Croix rivers in Minnesota; Chippewa, Black, and Wisconsin rivers in Wisconsin, and Rock River and Illinois River. Those that enter the Ohio from the north are the Wabash, Miami, Muskingum, Little Miami, Scioto, and McMahon rivers, Cross Creek, Mahoning, and Allegheny rivers. Those entering the Ohio from the south are the Monongahela, the Kanawha, the Cumberland, and the Tennessee. Entering below the mouth of the Ohio is the Yazoo.

MISSISSIPPI RIVER NEAR SAUK RAPIDS, MINN.

This station was established by W. R. Hoag April 23, 1903. It is located about 1½ miles south of Watab station on the Northern Pacific Railroad and about 5 miles north of Sauk Rapids, 7 miles north of St. Cloud. The gage is a vertical timber fastened to a post driven into the bed on the left side of the river. It is read daily by Frank McCrae. Discharge measurements are made from a boat running on a $\frac{5}{16}$-inch cable, which is securely fastened to trees on both sides of the river. The point to which the soundings are referred is a nail head in the root of a tree on the left bank, to which the cable is fastened. The channel is straight for 4,000 feet above the station and for 600 feet below. Both banks are high and not subject to overflow. The bed is regular, of sand and gravel, and is probably permanent. There is but one channel at all stages. The channel has a width of about 625 feet at low water and about 700 feet at high stages.

Bench mark No. 1 is the top of a large pointed rock 150 feet upstream from the gage and 10 feet from the water's edge. Its eleva-

tion above the zero of the gage is 18.58 feet. Bench mark No. 2 is a ⅝-inch iron stake, driven on the left shore between the cable and bench mark No. 1. Its elevation is 14.22 feet above the zero of the gage. Bench mark No. 3 is on the root of a small tree on the left bank just below the cable. Its elevation is 18.29 feet above the zero of the gage. A short distance above the old gage is a large rock with a vertical face at an elevation of 14.45 feet above the zero of the gage. Observations of the river height can be made by determining distances from the top of this rock to the water surface.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Mississippi River near Sauk Rapids, Minn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 3	W. R. Hoag	14.02	7,841
June 13	do	12.02	6,471
August 4	do	13.22	7,914
September 9	E. C. Murphy	11.85	5,015
Do	Murphy and Stockman	11.85	5,043
October 17	L. R. Stockman	15.60	17,448

Mean daily gage height, in feet, of Mississippi River near Sauk Rapids, Minn., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		13.85	12.05	12.80	11.80	13.30	12.85	12.70
2		13.70	12.15		11.70	13.25	12.70	12.45
3	14.00	13.60	12.40		11.90	13.45	12.70	12.45
4	14.05	13.30	13.15		11.85	14.80	12.70	12.45
5	14.15	12.95	12.80		11.85	15.35	12.70	12.28
6	14.25	12.65	12.50		11.75	16.10	12.60	11.99
7	14.35	12.60	12.65		11.55	17.10	12.50	11.95
8	14.25	12.15	12.75		12.00	17.05	12.40	11.95
9	14.20	12.25	13.20	12.80	11.85	17.15	12.40	11.95
10	14.30	12.20	13.40	12.70	12.10	17.10	12.35	12.13
11	14.80	12.15	13.20	12.50	12.55	16.80	12.30	12.45
12	15.30	12.10	13.10	12.90	13.00	16.60	12.20	12.28
13	15.75	12.05	13.00	12.80	13.80	16.45	12.20	12.28
14	16.10	11.95	13.20	12.50	14.25	16.15	12.05	12.28
15	16.25	11.80	13.45	12.40	15.25	16.00		12.45
16	15.60	11.90	13.10	12.05	15.55	15.85		12.66
17	15.50	12.00	11.90	12.10	15.65	15.65		12.66
18	15.25	11.80	11.90	11.75	15.75	15.55		12.45
19	15.10	11.85	11.80	11.85	15.70	15.45		12.37
20	14.95	12.05	11.65	11.70	15.60	15.20		11.40
21	14.90	12.00	11.35	11.75	15.45	15.05		11.40
22	14.85	12.10	11.55	11.75	15.30	14.85		11.20
23	14.85	11.65	11.50	11.75	15.00	14.70		11.10
24	14.90	12.00	11.55	11.70	14.70	14.50		11.00
25	14.90	11.60	11.70	11.50	14.60	14.30		11.00

Mean daily gage height, in feet of Mississippi River, etc.—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	14.75	11.75	11.60	12.00	14.50	14.10	.....	10.90
27	14.65	11.50	11.90	11.90	14.15	13.85	13.87	11.80
28	14.55	11.45	12.15	11.90	13.80	13.65	13.91	11.80
29	14.50	11.45	12.30	12.00	13.70	13.50	13.32	11.80
30	14.25	11.40	12.40	12.20	13.45	13.25	12.78	11.70
31	14.05	.....	12.45	12.20	.....	13.00	.....	11.70

RUM RIVER DRAINAGE BASIN.

Rum River rises in Lake Onamio in eastern Minnesota, flows south and enters the Mississippi near Anoka. In its course of about 100 miles it has a total fall of about 225 feet or an average fall of 2.25 feet per mile. This stream, though not very large, is fairly constant in its flow, due to its rising in the Mille Lacs region, and there are several points on it at which there are sudden falls of from 10 to 20 feet, consequently this is a fairly good stream for water-power purposes. The United States Geological Survey maintained a station on this river during the early part of 1903 at a point near St. Francis, Minn., where its drainage area is 1,330 square miles.

RUM RIVER AT ST. FRANCIS, MINN.

This station was established April 23, 1903, by W. R. Hoag, and is located one-half mile from St. Francis, Minn., and one-half mile below a dam and flour mill. The gage is a vertical 1½ by 6 inch board, 7 feet long, and is read once each day by R. G. Streetly. Discharge measurements are made from a boat running on a cable. The initial point for soundings is 20 feet from the center of the tree to which the cable is attached on the right bank. The channel is straight for 1,000 feet above and 400 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is of rock and gravel, and there is but one channel. The bench mark is on a 24-inch tree, 140 feet upstream on the north bank of the river, and is at an elevation of 6.46 feet above the zero of the gage. The station was discontinued in August, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Rum River at St. Francis, Minn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 23	W. R. Hoag	3.27	2,492
May 23	do	2.90	2,605
July 31	do	3.42	2,196
September 5	do	1.15	703

Mean daily gage height, in feet, of Rum River at St. Francis, Minn., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.70	2.30	1.30	.....	1.45	17	.....	5.15	1.60	3.80	.....	.....
2	.....	2.70	2.35	1.40	.....	1.50	18	.....	5.30	1.60	3.60	.....	.....
3	.....	2.75	2.30	1.50	.....	1.50	19	.....	4.80	1.55	3.70	.....	.....
4	.....	2.90	1.80	1.60	.....	1.45	20	.....	4.50	1.60	3.85	.....	.....
5	.....	2.95	1.60	1.00	.....	1.15	21	.....	4.10	1.40	3.70	.....	.....
6	.....	3.20	1.50	1.60	.....	.....	22	.....	3.20	1.30	3.50	.....	.....
7	.....	3.20	1.50	1.90	.....	.....	23	.....	2.90	1.20	3.40	.....	.....
8	.....	3.20	1.50	2.60	.....	.....	24	.....	2.50	1.00	3.40	1.35	.....
9	.....	3.15	1.60	2.95	.....	.....	25	.....	2.40	.90	3.35	.95	.....
10	.....	2.90	1.60	3.40	3.05	.....	26	3.00	2.50	.90	.....	1.25	.....
11	.....	2.80	1.50	3.90	2.70	.....	27	2.95	2.60	.90	.....	1.25	.....
12	.....	2.80	1.50	4.45	2.35	.....	28	3.00	2.40	.90	.....	1.30	.....
13	.....	3.00	1.45	4.40	2.15	.....	29	2.95	2.40	1.10	.....	1.35	.....
14	.....	3.20	1.45	4.35	2.00	.....	30	2.80	2.35	1.25	.....	.....	.....
15	.....	3.60	1.50	4.20	1.80	.....	31	.....	2.35	.....	.....	1.45	.....
16	.....	4.60	1.50	4.20	.....	.....							

ST. CROIX RIVER DRAINAGE BASIN.

St. Croix River is formed by the junction of Moose and Eau Claire rivers, both of which rise in Douglas County, Wis., flows south, forming for most of its course part of the boundary between Wisconsin and Minnesota, and enters the Mississippi near Prescott, Wis. This river has a rapid fall and in several places there are unusual opportunities for the development of water power. Prominent among these are Taylors Falls, Minn., and St. Croix, Wis. The United States Geological Survey has carried on during 1903 measurements of the flow at Taylors Falls, where the drainage area is 6,370 square miles.

ST. CROIX RIVER NEAR TAYLORS FALLS, MINN.

This station is located 4 miles upstream from Taylors Falls and about 3½ miles above the Falls of St. Croix, Wis. The gage heights are referred to four iron pins on the right bank just below the gaging station, the elevations of which are referred to the datum of the bench marks of the St. Croix River survey. Their elevations are as follows:

	Feet.
Pin No. 1	732.08
Pin No. 2	734.54
Pin No. 3	736.10
Pin No. 4	737.57

A large number of measurements were obtained during 1903, and the gage was read daily by V. H. Caneday. Discharge measurements were made from a boat held in place by a wire cable stretched across the river between two trees. The initial point for soundings is a vertical rod on the left bank. The channel is straight for about 800 feet above and 1,000 feet below the station, while the banks are high and can not overflow. The section is regular, smooth, and permanent,

and the velocity is never sluggish, making this on the whole a station at which good results are obtainable. Its drainage area at this point is 6,370 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of St. Croix River near Taylors Falls, Minn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 22	E. Johnson, jr	4.00	10,747
August 11	W. R. Hoag	2.70	7,470
October 9	L. R. Stockman	3.84	10,244

CHIPPEWA RIVER DRAINAGE BASIN.

Chippewa River rises in the southeastern part of Ashland County, Wis. It flows southwest, emptying into the Mississippi near Wabasha, Minn. Its principal tributary is the Flambeau, which enters from the east in Gates County. During the latter part of 1902 the United States Geological Survey began systematic measurements in this and other drainage basins of Wisconsin.

Gaging stations have been maintained in this basin on the Chippewa at Eau Claire, and on the Flambeau at Ladysmith, Wis.

CHIPPEWA RIVER NEAR EAU CLAIRE, WIS.

This station was established November 13, 1902, by L. R. Stockman. It is located 2 miles below Eau Clair, at a suburb known as Shawtown. The gage is a vertical board fastened to the downstream side of the center pier of the highway bridge. The gage is read twice each day by R. F. Duncan. Discharge measurements are made from the two-span highway bridge, at which a cable has been installed to be used as a stay wire for flood measurements. The channel is straight above and below the station, and the current is swift. The right bank is protected by a high masonry wall. The left bank is low, but the water is confined by an earthen embankment. The bed is composed of gravel, with a few rocks, and is permanent. There are two channels at all stages. The width is 450 feet at low water and 500 feet at flood stages.

Bench mark No. 1 is a nail in the top of a 6-inch white-oak stump which is attached to a tree still standing. It is located about 200 feet east of the road and 200 feet south of the river. Its elevation is 20.09 feet above the zero of the gage. The initial point for soundings is a point marked by two nails in the footway at the right end of the bridge, also marked 0 in white paint.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Chippewa River near Eau Claire, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 17	L. R. Stockman	4.15	[a] 1,979
February 10	do	3.80	[a] 1,778
March 9	do	4.85	[b] 3,818
April 6	do	7.40	10,688
May 5	do	11.85	26,458
June 15	do	4.70	4,107
July 10	do	9.25	17,167
August 20	do	5.13	4,336
September 5	do	6.20	8,032
October 13	do	8.77	15,087
November 24	do	4.90	3,511

[a] Frozen. [b] Partly frozen.

Mean daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1902.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
5		4.50	12		4.20	19	11.35	4.30	26	6.45	4.90
6		4.45	13		4.45	20	9.60	4.25	27	6.20	5.10
7		4.00	14	13.70	4.25	21	8.50	4.30	28	6.00	4.60
8		4.05	15	10.20	4.55	22	7.55	4.25	29	5.75	4.50
9		4.05	16	12.40	4.25	23	7.40	4.50	30	5.55	4.85
10		4.10	17	13.05	4.30	24	7.15	4.70	31		4.50
11		4.25	18	12.60	4.10	25	7.00	4.30			

Mean daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	3.70	3.20	6.85	12.80	(a)	7.65	5.05	5.90	6.90	5.55	(a)
2	4.35	4.25	3.75	7.15	13.10	(a)	8.05	5.20	6.45	7.00	5.55	(a)
3	4.15	4.10	3.85	7.45	12.15	(a)	10.60	5.85	5.65	7.35	5.45	(a)
4	4.20	4.05	3.90	7.95	11.85	(a)	13.50	6.85	5.85	9.90	5.50	(a)
5	4.40	4.10	3.75	7.85	11.55	(a)	15.30	7.50	5.75	11.25	5.25	(a)
6	3.90	4.05	3.75	7.40	10.90	(a)	15.20	9.10	6.45	11.65	5.20	4.30
7	4.15	4.15	3.85	7.50	10.30	6.85	13.75	9.00	5.85	11.60	5.15	4.65
8	4.40	4.15	4.10	7.90	9.20	5.45	11.30	11.05	6.30	11.15	5.10	4.50
9	4.20	4.00	4.60	8.55	9.15	6.45	10.30	6.70	8.00	11.35	5.05	4.60
10	4.40	3.85	5.05	8.00	7.65	5.95	9.40	7.55	8.05	10.95	5.00	4.70
11	4.80	3.80	5.80	7.60	8.95	6.50	10.10	7.25	9.15	9.95	5.00	4.55

[a] Observer absent.

Mean daily gage height, in feet, of Chippewa River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12	4.65	3.85	6.00	8.15	12.00	5.90	9.95	6.75	12.85	9.45	5.00	4.50
13	4.75	3.90	7.05	7.70	13.25	9.25	8.90	6.85	14.00	9.00	5.05	4.70
14	4.60	3.90	8.20	7.65	13.40	3.75	8.10	6.90	16.75	8.80	5.30	4.85
15	4.85	3.90	8.05	7.80	13.25	4.65	7.80	9.65	17.85	8.45	5.40	4.75
16	4.30	4.50	7.00	7.80	11.85	4.95	7.20	5.10	18.50	7.75	4.95	4.70
17	4.20	4.10	7.00	7.50	10.45	4.95	6.50	6.80	17.45	7.70	4.95	4.60
18	4.30	4.15	7.55	6.75	9.90	4.90	8.80	6.65	15.50	7.40	4.25	4.65
19	4.65	4.30	11.80	6.65	9.15	4.30	5.95	6.00	13.45	7.55	4.40	4.65
20	4.40	4.25	13.95	6.85	9.15	5.15	6.70	5.10	11.80	7.05	4.15	4.60
21	4.50	4.20	13.65	6.80	9.30	4.70	6.15	5.15	10.50	7.05	4.20	4.60
22	4.35	3.35	12.65	6.65	9.50	4.20	5.70	7.50	9.95	6.75	4.35	4.80
23	4.35	3.80	11.70	6.40	9.05	4.20	5.60	5.60	9.15	6.70	4.85	4.70
24	4.45	4.15	10.45	6.40	9.10	4.15	6.00	5.10	7.80	6.55	4.95	4.80
25	3.50	4.05	9.40	8.60	9.85	4.25	9.20	5.15	7.60	6.30	4.95	4.00
26	4.20	3.90	8.75	6.55	10.20	4.15	5.25	5.25	7.00	6.15	4.90	4.40
27	4.10	3.95	8.40	7.15	12.50	6.75	5.05	4.70	7.65	5.95	4.85	3.40
28	4.10	3.85	7.75	7.00	15.15	4.20	5.20	5.45	7.05	6.10	4.60	3.70
29	3.85	.....	7.60	7.30	16.70	4.60	5.15	5.60	7.05	6.10	.....	3.60
30	4.15	.....	7.15	11.70	16.10	4.95	5.15	5.20	7.05	6.10	.....	3.60
31	4.25	.....	6.80	.....	.....	.....	5.10	5.60	.....	5.90	.....	3.40

Rating table for Chippewa River near Eau Claire, Wis., from March 12 to December 1, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.8	2,160	5.7	6,290	7.6	11,310	11.0	23,310
3.9	2,340	5.8	6,530	7.7	11,610	11.2	24,070
4.0	2,530	5.9	6,770	7.8	11,910	11.4	24,830
4.1	2,730	6.0	7,010	7.9	12,210	11.6	25,590
4.2	2,930	6.1	7,270	8.0	12,510	11.8	26,350
4.3	3,130	6.2	7,530	8.2	13,150	12.0	27,110
4.4	3,330	6.3	7,790	8.4	13,790	12.5	29,010
4.5	3,540	6.4	8,050	8.6	14,450	13.0	30,910
4.6	3,760	6.5	8,310	8.8	15,130	13.5	32,810
4.7	3,980	6.6	8,570	9.0	15,810	14.0	34,710
4.8	4,200	6.7	8,830	9.2	16,530	14.5	36,610
4.9	4,420	6.8	9,090	9.4	17,250	15.0	38,510
5.0	4,640	6.9	9,350	9.6	17,990	15.5	40,410
5.1	4,860	7.0	9,610	9.8	18,750	16.0	42,310
5.2	5,090	7.1	9,890	10.0	19,510	16.5	44,210
5.3	5,330	7.2	10,170	10.2	20,270	17.0	46,110
5.4	5,570	7.3	10,450	10.4	21,030	17.5	48,010
5.5	5,810	7.4	10,730	10.6	21,790	18.0	49,910
5.6	6,050	7.5	11,010	10.8	22,550		

Rating table for Chippewa River near Eau Claire, Wis., from November 30, 1902, to March 12, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.2	840	4.0	1,985	4.8	3,610	5.6	5,670
3.3	940	4.1	2,165	4.9	3,850	5.7	5,930
3.4	1,055	4.2	2,345	5.0	4,110	5.8	6,190
3.5	1,190	4.3	2,535	5.1	4,370	5.9	6,450
3.6	1,335	4.4	2,735	5.2	4,630	6.0	6,710
3.7	1,490	4.5	2,940	5.3	4,890		
3.8	1,655	4.6	3,150	5.4	5,150		
3.9	1,825	4.7	3,370	5.5	5,410		

To be used only when river is frozen.

Estimated monthly discharge of Chippewa River near Eau Claire, Wis.

[Drainage area, 6,740 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
November [a]			14,835	2.20	1.39
December [b]			2,789	.41	.41
1903.					
January	3,730	1,190	2,593	.38	.44
February	2,940	995	2,023	.30	.31
March	34,520	840	11,573	1.72	1.98
April	25,970	8,050	11,240	1.67	1.86
May [c]	44,970	11,460	24,761	3.67	4.23
June [d]	36,990	2,070	8,720	1.29	1.44
July	39,650	4,750	14,698	2.18	2.51
August	23,500	3,980	8,602	1.28	1.48
September	51,810	6,170	19,584	2.90	3.24
October	25,780	6,770	13,524	2.01	2.32
November	5,930	2,830	4,562	.68	.76
December	3,980	1,055	2,855	.42	.48
The year	51,810	840	10,395	1.54	21.05

[a] 13 to 29, inclusive. [b] 5 to 31, inclusive. [c] May 31, estimated. [d] 1 to 4, inclusive, estimated.

FLAMBEAU RIVER NEAR LADYSMITH, WIS.

This station was established February 13, 1903, by L. R. Stockman. It is located three-fourths mile south of the Minneapolis, St. Paul

and Sault Ste. Marie Railroad station, three-fourths mile south of Ladysmith, and one-half mile below the dam of the Menasha Pulp Company. The standard chain gage is fastened to the upstream side of the right span. The length of the chain from the end of the weight to the marker is 25.40 feet. The gage is read twice each day by J. A. Newlun. Discharge measurements are made from the three-span highway bridge, to which the gage is attached. The initial point for soundings is a point marked by two nails and a straight white line at the right end of the bridge. The channel is straight for about 500 feet above and below the station. The right bank is low, but the overflow passes beneath the bridge. The left bank is high and covered with trees. The gaging section is broad and shallow, with a bed of small bowlders, gravel, and sand, and is not liable to shift. The stream is divided into three channels by the bridge piers. The channels are somewhat obstructed by log jams during the rafting season. The bench mark is a cut on a rivet head on the post to which the pulley of the chain gage is attached. When the gage reads zero this mark is 36.28 feet above the water surface. An arrow cut on the iron guard rail is exactly opposite the 10-foot mark of the scale of the chain gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Flambeau River near Ladysmith, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 13	L. R. Stockman	16.20	[a] 773
March 19	do	18.95	[b] 3,312
April 8	do	17.40	3,727
May 6	do	18.97	7,113
June 16	do	16.00	1,345
July 11	do	18.10	4,222
August 21	do	16.85	2,681
September 10	E. C. Murphy	18.05	5,303
October 23	L. R. Stockman	17.21	3,899

[a] River frozen. [b] Log jam below.

Mean daily gage height, in feet, of Flambeau River near Ladysmith, Wis., for 1903.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	16.15	17.00	18.30	19.80	15.65	.....	17.00	17.20	16.00	15.90
2	.....	16.60	16.80	18.40	19.65	16.15	.....	16.70	17.30	16.25	15.75
3	.....	16.50	16.90	18.60	18.95	17.25	.....	16.80	17.60	15.85	15.95
4	.....	16.10	16.90	19.05	18.60	18.10	.....	16.30	19.65	15.85	15.60
5	.....	16.30	17.05	19.10	18.10	18.90	.....	16.80	19.70	15.85	15.80
6	.....	16.50	16.40	19.10	17.55	19.05	.....	16.90	19.35	15.85	15.80

Mean daily gage height, in feet, of Flambeau River, etc.—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
7	.....	16.60	16.90	19.10	17.55	19.20	.....	16.90	19.25	15.90	16.95
8	.....	16.10	17.45	18.80	17.30	18.85	.....	17.30	19.25	15.65	15.80
9	.....	16.50	17.35	18.70	16.95	18.70	.....	18.20	19.30	15.70	14.70
10	.....	16.50	17.25	17.95	16.60	18.60	18.20	18.20	19.35	15.85	16.50
11	.....	16.05	17.25	18.25	16.75	18.75	18.00	18.00	18.95	16.00	16.35
12	.....	16.45	17.30	18.80	16.80	18.55	17.90	18.40	18.65	15.85	16.30
13	.....	16.35	17.25	19.55	16.30	18.30	17.80	19.00	18.45	15.85	16.50
14	.....	16.35	17.50	19.80	16.15	17.85	17.70	19.80	18.25	15.80	16.45
15	16.00	16.60	17.40	19.65	16.35	17.70	17.50	20.40	17.90	15.80	16.55
16	16.10	16.15	17.20	19.55	16.50	17.65	17.30	20.50	17.85	15.75	16.35
17	16.05	16.20	16.95	19.40	16.05	17.60	17.30	20.50	17.80	15.80	16.40
18	16.00	16.30	17.00	19.45	16.05	17.35	17.20	20.30	17.50	15.00	16.70
19	15.90	18.25	16.90	19.05	15.85	17.35	17.00	20.00	17.35	15.50	16.60
20	16.00	20.35	16.85	19.20	15.80	17.20	17.00	19.70	17.25	15.50	16.67
21	15.90	19.30	16.90	19.25	15.85	17.15	17.10	19.30	17.25	15.45	16.67
22	16.05	18.50	16.65	18.85	15.95	16.70	16.90	18.90	17.15	15.25	16.67
23	16.00	18.45	16.65	19.15	15.65	16.70	16.70	18.50	17.05	15.40	16.66
24	16.25	17.30	17.30	18.90	15.90	16.70	16.80	18.20	17.00	15.65	17.00
25	16.00	17.60	17.30	19.00	15.60	16.80	17.10	18.00	16.80	15.45	16.69
26	15.95	17.25	17.25	19.55	15.85	(a)	16.80	17.70	17.00	15.55	16.66
27	16.40	17.00	17.15	20.60	15.60	(a)	17.00	17.85	16.80	15.85	16.50
28	16.25	17.10	17.20	21.45	15.70	(a)	16.90	17.50	16.55	15.80	16.10
29	.....	17.00	17.40	21.45	15.95	(a)	16.80	17.30	16.65	15.80	16.80
30	.....	16.75	18.45	21.20	15.80	(a)	16.70	17.20	16.05	15.85	16.80
31	.....	16.60	.....	21.45	.....	(a)	16.80	.....	16.20	.....	16.70

[a] Chain gage stolen.

Rating table for Flambeau River near Ladysmith, Wis., from March 19 to December 1, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
15.0	530	16.3	1,765	17.6	4,280	18.9	7,140
15.1	555	16.4	1,925	17.7	4,500	19.0	7,360
15.2	600	16.5	2,085	17.8	4,720	19.2	7,800
15.3	665	16.6	2,245	17.9	4,940	19.4	8,240
15.4	745	16.7	2,405	18.0	5,160	19.6	8,680
15.5	825	16.8	2,575	18.1	5,380	19.8	9,120
15.6	915	16.9	2,755	18.2	5,600	20.0	9,560
15.7	1,010	17.0	2,960	18.3	5,820	20.2	10,000
15.8	1,110	17.1	3,180	18.4	6,040	20.4	10,440
15.9	1,220	17.2	3,400	18.5	6,260	20.6	10,880
16.0	1,340	17.3	3,620	18.6	6,480	21.0	11,760
16.1	1,465	17.4	3,840	18.7	6,700		
16.2	1,610	17.5	4,060	18.8	6,920		

Made from measurements between gage heights 16 and 18.95 feet. Curve above and below these points is approximate. To be used only for open river.

Estimated monthly discharge of Flambeau River near Ladysmith, Wis., for 1903.

[Drainage area, 2,120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January					
February [a]			860	0.41	0.21
March	10,330	833	2,736	1.29	1.49
April	6,150	1,925	3,266	1.54	1.72
May	12,750	5,050	8,187	3.86	4.45
June	9,120	915	2,749	1.30	1.45
July [b]			4,598	2.17	2.02
August [c]			3,431	1.62	1.33
September	10,660	1,765	5,777	2.72	3.03
October	8,900	1,400	4,807	2.27	2.62
November	1,685	530	1,054	.50	.56
December					

[a] February 15 to 28, inclusive. [b] July 1 to 25, inclusive. [c] August 10 to 31, inclusive.

BLACK RIVER DRAINAGE BASIN.

Black River rises in Taylor County, Wis., and flows southwest, emptying into the Mississippi about 20 miles above La Crosse. The United States Geological Survey maintained a station on this river at Melrose during part of the year 1903.

BLACK RIVER NEAR MELROSE, WIS.

This station was established November 12, 1902, by L. R. Stockman. It is located 1 mile south of Melrose, Wis., on the highway bridge. The river at this point flows in two channels, which at present have practically the same elevation. The gage is a plain staff, graduated to feet and tenths, nailed to the piling of the bridge. It is read daily by William H. Westfall. The channel is straight both above and below the station for about 500 feet. Both banks are high. The bed of the stream is sandy and shifting. The initial point for soundings is a nail in the footboard on the right bank. Bench mark No. 1 consists of a nail driven into the root of a 16-inch black oak 50 feet west of the north end of the bridge; elevation, 15.23 feet above zero of the gage. Bench mark No. 2 is a nail in the root of a white-oak tree 35 feet west of the north end of the bridge. Its elevation is 14.72 feet above the zero of the gage. This station was discontinued August 1, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Black River near Melrose, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 15	L. R. Stockman	4.30	[a] 598
February 7	do	4.30	[a] 508
April 4	do	5.90	2,982
May 1	do	11.00	10,931
June 13	do	3.90	842

[a] Frozen.

Mean daily gage height, in feet, of Black River near Melrose, Wis.

Day.	1902.	1903.							
	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1		5.05	4.10	4.30	5.10	11.00	7.60	3.60	3.75
2		5.00	4.10	4.35	4.85	10.00		6.70	
3		4.90	4.10	4.40	5.30	10.25		11.20	
4	3.75	4.75	4.10	4.45	5.65	10.50		10.90	
5	3.95	4.60	4.10	4.60	5.90	9.65	6.00	13.00	
6	4.00	4.60	4.20	4.75	6.50	9.05	4.70	12.30	
7	3.80	4.50	4.20	([a])	6.65	8.15	4.40	10.20	
8	4.35	4.50	4.20	6.25	6.50	7.00	4.30	7.90	
9	4.35	([a])	4.20	8.20	6.20	6.95	4.25	6.90	
10	4.30	4.40	4.20	9.30	5.50	6.55	4.00	7.40	
11	4.35	4.40	4.30	9.70	5.60	6.10	4.00	8.70	
12	4.20	4.40	4.25	10.75		6.65	3.95	7.20	
13	4.20	4.40	4.20	12.05	5.45	10.60	3.95	6.70	
14	4.10	4.40	4.20	12.55	5.60	12.00	3.80	6.20	
15	4.15	([a])	4.20	11.55	5.95	10.90	3.80	5.80	
16	4.10	4.30	4.10	9.85	5.85	9.15	3.80	5.30	
17	4.00	4.30	4.15	9.40	6.05	7.80	3.70	4.50	
18	4.00	4.30	4.00	10.35	5.60	6.55	3.70	4.20	
19	4.05	4.30	3.95	11.95	5.00	6.50	3.70	4.10	
20	4.25	4.20	3.90	13.40	5.15	6.40	3.70	4.00	
21	4.60	4.20	3.90	12.90	4.50	6.30	3.70	4.00	
22	4.95	4.20	4.00	11.40	4.65	5.90	3.70	4.00	
23	5.80	4.20	4.00	9.65	4.30	6.50	3.70	3.90	
24	6.05	4.20	4.00	8.05	4.30	5.70	3.60	3.90	
25	5.85	4.20	4.05	7.65	4.35	5.80	3.60	3.90	
26	5.80	4.20	4.10	6.65	4.65	5.95	3.50	3.75	
27	5.65	4.20	4.20	6.02	4.85	8.40	3.50	3.90	
28	5.50	4.20	4.35	6.55	5.00	11.85	3.50	4.20	
29	5.35	4.20		5.70	5.65	12.60	3.50	4.00	
30	5.20	4.20		6.55	6.80	10.95	3.50	3.80	
31		4.10		5.30		9.50		3.75	

[a] Observer absent.

WISCONSIN RIVER DRAINAGE BASIN.

Wisconsin River is the largest river in the State of Wisconsin. It rises in the northern part and flows south through the central portion of the State to Portage, where it turns at nearly a right angle and flows west, emptying into the Mississippi about 60 miles above Dubuque.

Gaging stations have been established in this basin at Necedah, Muscoda, and Merrill. These stations divide the river into three nearly equal reaches of about 90 miles each, so furnishing ample opportunity for a systematic study.

WISCONSIN RIVER AT MUSCODA, WIS.

This station was established December 20, 1902, by L. R. Stockman. It is situated three-fourths of a mile north of Muscoda on the toll highway bridge. The gage is a horizontal wire with a scale board graduated to feet and tenths and fastened to the top of the bridge. The initial point for soundings is on the left bank, at the end of the drawbridge. The channel is straight for 1,500 feet above and 1,000 feet below the station, and has a width of about 800 feet, broken by 13 piers. The right bank is low and liable to overflow. The water is confined to the bridge opening. The left bank is high and rocky. The bed of the stream is rocky, with spots of gravel, and is liable to shift. The flow is moderately rapid. The gage is read twice a day by Charles H. Lovell, the bridge tender.

Bench mark No. 1, elevation 684 feet above sea level, bolt in south end of east guard rail at south end of bridge. Its elevation has been determined by United States Geological Survey levels. Bench mark No. 2, elevation 681.17 feet, nail in root on north side of 20-inch black oak tree standing about 40 paces south by east from the south end of the drawbridge. Bench mark No. 3, elevation 680.95 feet, a projecting point on a sandstone rock on the east end of south abutment, near the supporting wheel at end of drawbridge. On the vertical face of the stone is an arrow pointing upward to this point. The stone is also marked B. M. Bench mark No. 4, elevation 684.25 feet, a point marked X on foundation stone at the southeast corner of Lampi's brewery. The 15-foot mark has an elevation of 668.62 feet. There is a line cut on the girder opposite the 10-foot mark. This station was discontinued December 31, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Wisconsin River at Muscoda, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 10	L. R. Stockman	14.85	[a] 4,812
January 28	do	14.65	[a] 4,649
March 26	do	19.70	38,182
April 21	do	16.25	14,163
July 2	A. C. Lootz	15.20	5,870
October 9	L. R. Stockman	18.33	18,954

[a] Partly frozen.

Mean daily gage height, in feet, of Wisconsin River at Muscoda, Wis., for 1902.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
20	15.00	23	15.05	26	14.80	29	14.55
21	15.05	24	15.05	27	14.70	30	14.75
22	15.00	25	14.85	28	14.55	31	14.75

Mean daily gage height, in feet, of Wisconsin River at Muscoda, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	14.75	14.90	15.85	18.05	15.97	18.68	15.23	15.40	16.78	18.05	16.52	16.33
2	14.85	14.90	15.80	17.50	16.07	18.95	15.18	15.43	16.68	17.85	16.42	16.25
3	14.90	14.95	15.70	17.25	15.98	19.28	15.25	15.30	16.65	17.75	16.40	16.25
4	14.90	15.00	15.60	17.02	16.35	19.55	15.18	15.38	16.83	17.32	16.32	16.22
5	14.90	14.90	15.50	16.75	17.15	19.78	15.20	15.53	16.85	17.30	16.32	16.22
6	14.90	14.90	15.40	16.70	17.70	19.52	17.00	15.68	16.73	17.32	16.30	16.20
7	14.80	14.85	15.55	16.60	17.95	18.50	17.90	15.55	16.53	17.47	16.25	16.35
8	14.70	14.85	15.90	16.50	18.07	17.75	18.40	15.58	16.50	17.87	16.17	16.35
9	14.65	15.00	15.70	16.32	18.22	17.42	18.60	16.05	16.63	18.40	16.10	16.40
10	14.75	15.00	15.40	16.22	18.40	17.07	18.90	16.75	16.85	18.60	16.10	16.38
11	14.65	15.05	15.20	16.20	18.40	16.85	19.10	17.33	16.98	18.60	16.20	16.30
12	14.60	15.15	15.00	16.22	18.20	16.65	19.08	17.43	17.12	18.65	16.20	16.32
13	14.65	15.20	15.05	16.30	17.80	16.47	18.85	17.28	17.48	18.85	16.12	16.32
14	14.70	15.15	15.55	16.22	17.50	16.22	17.63	17.15	17.83	18.90	16.10	.....
15	14.65	15.05	15.75	16.12	17.45	16.15	17.30	17.23	17.75	19.00	16.10	16.15
16	14.75	15.00	16.30	16.00	17.50	16.05	16.95	17.47	17.83	18.72	16.05	16.15
17	14.75	14.85	16.50	16.00	17.90	15.87	16.87	17.47	18.38	18.35	16.10	16.25
18	14.70	14.70	16.65	16.10	18.15	15.82	17.45	17.37	18.90	18.05	16.15	16.28
19	14.75	14.70	16.95	16.20	18.25	15.65	16.92	17.13	19.30	17.90	16.10	16.42
20	14.80	14.65	17.45	16.30	18.40	15.65	16.65	17.05	19.80	17.75	16.32	15.62
21	14.70	14.70	17.85	16.35	18.20	15.73	16.45	16.95	20.80	17.47	17.00	15.62
22	14.75	14.65	17.93	16.30	18.00	15.63	16.25	16.70	22.23	17.37	17.05	15.72
23	14.70	14.70	18.05	16.12	17.45	15.53	16.17	16.53	22.70	17.27	17.25	15.75
24	14.80	14.75	18.35	16.00	17.30	15.45	16.05	16.30	22.43	17.17	17.30	15.78
25	14.70	14.75	18.90	15.90	17.45	15.40	15.85	16.23	22.50	17.00	17.27	15.72
26	14.75	14.75	19.72	15.78	17.60	15.43	15.65	16.23	21.38	16.87	17.12	15.65
27	14.85	14.95	20.50	15.70	17.75	15.30	15.58	16.43	20.70	16.72	16.47	16.40
28	14.85	15.90	20.37	15.62	17.95	15.13	15.60	16.65	19.95	16.67	16.40	16.40
29	14.95	.....	19.80	15.67	18.20	15.10	15.58	17.08	19.10	16.60	16.33	16.40
30	14.80	.....	19.27	15.87	18.25	15.23	15.48	17.08	18.35	16.55	16.30	16.40
31	14.90	.....	18.65	.....	18.40	.....	15.45	16.98	.....	16.55	.....	16.40

WISCONSIN RIVER NEAR NECEDAH, WIS.

This station was established December 2, 1902, by L. R. Stockman. It is located on the highway toll bridge 3 miles east of Necedah, Wis., and 3 miles from the Chicago, Milwaukee and St. Paul and Chicago and Northwestern Railroad stations. Yellow River flows into the Wisconsin about 4 miles below the station. There are islands both above and below the station, but they are several hundred feet away. The gage is a vertical board graduated to feet and tenths and fastened to the lower end of the center pier. It is read twice each day by Edw. Bundy. Discharge measurements are made from the two-span highway bridge to which the gage is attached. The initial point for soundings is a point over the right abutment, marked by a nail in the floor of the bridge and also marked zero with paint. The general direction of the channel is straight for 2,000 feet above and below the station. The velocity is rapid and rather poorly distributed on account of an ice breaker above the middle pier and the variation in width of the channel just above the bridge. The width of the channel at ordinary stages is about 325 feet, broken by one pier. The right bank is high and rocky; the left bank overflows, making the width of the channel from 500 to 600 feet. During the spring floods of 1903 the water overflowed the turnpike. The right side of the bed of the stream is rocky, but the remainder is sandy and liable to shift.

Bench mark No. 1 is a nail in the top of a red-oak stump, 2½ feet in diameter, about 60 feet south of the center of the roadbed and about 50 feet from the river at ordinary stages. Its elevation above the zero of the gage is 12.99 feet. Bench mark No. 2 is a nail in the root of a large cottonwood tree, 280 feet south of the bridge and about 80 feet from the river. Its elevation above the zero of the gage is 11.90 feet. Bench marks Nos. 1 and 2 are on the east side of the river. Bench mark No. 3 is a cross on a large sandstone rock, 70 feet south of the center of the roadway and 15 feet west of the water's edge on the west bank of the river. Its elevation above the zero of the gage is 20.36 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Wisconsin River near Necedah, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 13	L. R. Stockman	5.65	[a] 2,840
February 5	do	5.80	[a] 2,585
March 5	do	5.80	[a] 2,422
March 26	E. Johnson, jr	11.05	21,284
April 2	L. R. Stockman	7.55	10,187
April 28	do	6.50	7,123
June 12	do	6.00	5,888
July 7	do	10.50	20,855
August 19	do	6.20	6,962
September 4	do	5.30	5,047
October 12	do	9.43	12,501

[a] Frozen.

Mean daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1903.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
1		8	4.30	14	5.30	20	5.45	26	6.30
2	4.90	9	4.85	15	5.35	21	5.30	27	6.00
3	4.95	10	5.25	16	5.65	22	5.30	28	6.15
4	5.10	11	5.20	17	5.65	23	5.40	29	6.05
5	4.85	12	5.40	18	5.30	24	5.60	30	6.20
6	4.75	13	5.25	19	5.50	25	6.40	31	6.00
7	4.70								

Mean daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.90	5.75	5.75	7.70	6.65	10.55	4.70	4.80	5.20	7.10	5.70	5.60
2	5.90	5.70	5.60	7.55	8.30	9.85	4.60	4.95	5.50	6.60	5.55	6.20
3	5.80	5.90	5.85	7.35	9.35	8.85	7.70	4.75	5.40	6.80	5.70	6.90
4	5.75	5.80	5.80	7.50	9.75	8.15	8.90	4.80	5.30	6.80	5.75	7.10
5	5.60	5.75	5.75	7.40	9.95	7.60	10.10	4.85	5.30	7.05	5.55	6.80
6	5.70	5.90	5.80	7.25	10.15	7.40	10.00	5.65	5.40	8.30	5.45	6.80
7	5.65	5.80	5.90	7.15	10.05	7.15	10.60	6.65	5.60	9.05	5.30	6.60
8	5.45	5.70	5.50	7.20	9.70	6.85	10.60	7.75	6.10	8.95	5.50	6.70
9	5.60	5.60	5.50	7.10	9.30	6.65	9.70	8.00	6.10	9.15	5.35	6.50
10	5.50	5.80	6.25	7.25	8.80	6.55	8.40	7.70	6.80	9.80	5.30	6.40
11	5.45	5.75	6.40	7.05	8.25	6.20	7.80	7.50	7.30	9.80	5.25	6.30
12	5.50	5.65	7.05	6.90	8.15	6.00	7.50	7.20	7.30	9.35	5.30	6.00
13	5.65	5.90	7.05	6.80	8.45	6.15	7.10	6.90	7.20	8.90	5.30	[a] 4.10
14	5.75	5.80	6.75	6.75	9.05	5.85	6.70	6.70	8.60	8.30	5.30	4.40
15	5.45	5.75	7.30	6.80	9.80	5.70	6.55	6.70	10.90	7.90	5.35	4.50

[a] River frozen December 13 to 31.

Mean daily gage height, in feet, of Wisconsin River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	5.80	5.65	7.75	6.95	10.10	5.45	6.25	6.40	12.50	7.65	5.25	4.40
17	5.65	5.65	8.35	7.10	9.90	5.35	6.00	6.20	13.40	7.55	5.35	4.00
18	5.55	5.55	8.70	7.25	9.35	5.60	6.10	6.40	14.60	7.25	4.90	4.40
19	5.45	5.75	8.85	7.10	8.70	5.45	5.90	6.10	14.60	6.95	4.90	4.30
20	5.75	5.70	10.00	6.90	8.30	5.25	6.00	5.70	14.60	7.00	5.00	5.00
21	5.65	5.70	11.40	6.50	7.95	5.15	5.90	5.90	13.80	6.95	5.10	4.80
22	5.55	5.65	12.70	6.55	7.90	4.90	5.60	5.40	12.70	6.55	5.05	4.90
23	5.85	5.55	13.55	6.30	7.75	5.20	5.40	5.10	11.40	6.40	4.95	4.90
24	5.80	5.70	12.85	6.20	7.45	4.95	5.20	5.10	10.60	6.40	5.20	4.80
25	5.80	5.65	11.80	6.05	7.35	4.70	5.30	5.40	9.90	6.30	5.20	4.70
26	5.65	5.65	10.90	6.10	7.60	4.80	5.30	5.20	8.70	6.10	5.05	4.70
27	5.85	5.70	10.05	6.35	8.00	4.75	5.00	5.30	8.15	6.05	5.00	4.90
28	5.80	5.85	9.35	6.50	8.70	4.80	5.10	5.30	7.95	5.95	5.15	4.80
29	5.70	.....	8.95	6.85	9.55	4.70	5.00	5.20	7.65	6.00	5.00	4.90
30	5.80	.....	8.50	6.60	10.55	4.85	4.90	5.00	7.55	5.80	5.40	4.90
31	5.80	.....	8.00	.....	11.00	.....	4.80	5.00	.....	5.70	.....	4.90

Rating table for Wisconsin River near Necedah, Wis., from March 10 to July 5, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.6	3,400	5.9	5,680	7.2	9,160	9.0	14,800
4.7	3,540	6.0	5,900	7.3	9,460	9.2	15,440
4.8	3,690	6.1	6,130	7.4	9,760	9.4	16,080
4.9	3,840	6.2	6,370	7.5	10,060	9.6	16,720
5.0	4,000	6.3	6,620	7.6	10,360	9.8	17,360
5.1	4,160	6.4	6,880	7.7	10,670	10.0	18,000
5.2	4,320	6.5	7,150	7.8	10,980	10.5	19,600
5.3	4,490	6.6	7,430	7.9	11,290	11.0	21,200
5.4	4,670	6.7	7,710	8.0	11,600	11.5	22,920
5.5	4,860	6.8	8,000	8.2	12,240	12.0	24,670
5.6	5,060	6.9	8,290	8.4	12,880	13.0	28,360
5.7	5,260	7.0	8,580	8.6	13,520		
5.8	5,470	7.1	8,870	8.8	14,160		

Flood in July changed channel.

Rating table for Wisconsin River near Necedah, Wis., from July 6 to December 12, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.8	4,200	6.1	6,730	7.4	10,440	9.4	17,160
4.9	4,350	6.2	6,970	7.5	10,760	9.6	17,840
5.0	4,510	6.3	7,220	7.6	11,080	9.8	18,520
5.1	4,680	6.4	7,480	7.7	11,410	10.0	19,200
5.2	4,860	6.5	7,750	7.8	11,740	10.5	20,900
5.3	5,040	6.6	8,030	7.9	12,070	11.0	22,600
5.4	5,230	6.7	8,320	8.0	12,400	11.5	24,300
5.5	5,430	6.8	8,620	8.2	13,080	12.0	26,000
5.6	5,630	6.9	8,920	8.4	13,760	12.5	27,700
5.7	5,840	7.0	9,220	8.6	14,440	13.0	29,400
5.8	6,050	7.1	9,520	8.8	15,120	14.0	32,800
5.9	6,270	7.2	9,820	9.0	15,800		
6.0	6,500	7.3	10,130	9.2	16,480		

Estimated monthly discharge of Wisconsin River near Necedah, Wis., for 1903.

[Drainage area, 5,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January			[a] 2,600	0.45	0.52
February			[a] 2,550	.44	.46
March [b]	30,450		11,859	2.04	2.35
April	10,670	6,015	8,322	1.43	1.60
May	21,200	7,570	14,492	2.50	2.88
June	19,760	3,540	6,897	1.19	1.33
July	21,240	3,400	9,022	1.56	1.80
August	12,400	4,125	6,648	1.15	1.33
September	34,840	4,860	15,832	2.73	3.05
October	18,520	5,840	10,586	1.83	2.11
November	5,945	4,350	5,007	.86	.96
December 1-12 [c]	9,520	[d] 5,630	[d] 7,798	[d] 1.34	[d] .60

[a] Estimated.
[b] March 1 to 9, inclusive, estimated.
[c] December 13 to 31, river frozen.
[d] Twelve-day period.

WISCONSIN RIVER AT MERRILL, WIS.

This station was established November 17, 1902, by L. R. Stockman. It is located on the highway bridge in the city of Merrill, Wis., three

blocks from the Lincoln County court-house, one-half mile from the Chicago, Milwaukee and St. Paul Railroad station, and 1,000 feet below the dam of the electric power house. Prairie River enters about one-half mile above the station and there is an island about 600 feet below. There is a vertical gage fastened to the mill abutment, from which part of the gage readings for 1903 have been made. June 17, 1903, a chain gage was established on the bridge and made to read the same as the old gage at the mill. It is fastened to the guard timber on the downstream side, and the zero is marked by a brass screw driven into the guard timber. The fall of the water from the old to the new gage is 2.70 feet when the water is at a high stage. The length of the chain from the end of the weight to the marker is 23.60 feet. The gage is read twice each day by A. F. Lueck. The initial point for soundings is a nail in the footboard at the left end of the bridge, opposite the center of the iron hand-rail post. This point is marked "zero." Discharge measurements are made from the 2-span highway bridge, to which the chain gage is fastened. Each span of the bridge is 175 feet in length. The channel is straight from the dam above to the bridge and for about 400 feet below. The velocity is rapid and the surface rough. The station is so near the dam that at high stages the velocity is affected and it is possible that the bed of the stream may be subject to slight change, although it is of rock and gravel and is very rough. The channel is about 300 feet wide at at low stages and 400 feet wide at high water. Both banks are high and do not overflow. Bench mark No. 1 is a cross cut in the sandstone rock in the bridge seat of the abutment nearest to the city. Its elevation above the zero of the gage is 16.25 feet. This bench mark is 18.28 feet below the United States bench mark located at the corner of the engine house opposite the city hall.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Wisconsin River at Merrill, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 20	L. R. Stockman	4.05	[a] 1,376
February 16	do	3.70	[a] 1,250
March 20	do	8.90	9,995
May 7	do	6.85	7,893
June 7	do	4.72	2,258
July 13	do	5.70	2,993
August 22	do	5.00	2,638
September 11	E. C. Murphy	6.59	5,614
October 24	L. R. Stockman	6.08	4,159

[a] Partly frozen.

Mean daily gage height, in feet, of Wisconsin River at Merrill, Wis., for 1902.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
10	.....	4.00	16	3.60	3.85	22	1.55	3.80	28	0.05	3.80
11	.....	3.95	17	3.80	3.85	23	1.05	3.75	29	.10	3.70
12	.....	4.00	18	2.50	3.90	24	.90	3.85	30	.....	3.70
13	.....	4.00	19	2.05	3.85	25	1.05	4.05	31	.....	3.70
14	.....	3.85	20	1.90	4.05	26	.55	3.95			
15	.....	3.65	21	1.90	3.80	27	.15	3.90			

Mean daily gage height, in feet, of Wisconsin River at Merrill, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.65	3.80	3.70	6.75	6.65	.....	7.05	4.30	.....	6.50	5.85	5.10
2	3.70	3.80	3.70	6.70	8.30	.....	7.65	4.30	5.50	5.90	5.60	5.10
3	3.85	3.85	3.80	6.55	.....	.....	7.65	4.90	5.70	6.90	5.30	5.25
4	3.80	3.80	3.75	6.65	.....	.....	8.70	5.60	5.80	7.85	5.30	5.10
5	3.75	3.85	3.80	6.75	.....	.....	8.80	6.55	6.00	8.00	5.30	5.25
6	3.70	3.85	3.70	6.70	.....	.....	8.70	7.45	6.10	7.80	5.75	5.15
7	3.75	3.90	3.80	6.80	.....	.....	8.30	7.35	6.10	8.85	5.30	5.20
8	3.70	3.80	3.75	6.90	.....	.....	8.10	7.25	6.50	8.55	5.10	5.20
9	3.65	3.90	3.75	6.75	.....	.....	7.70	(a)	6.00	8.35	5.20	5.15
10	3.65	3.85	3.90	6.70	.....	.....	7.60	.....	6.80	8.20	5.10	[illegible]
11	3.70	3.55	4.05	6.75	.....	.....	7.50	.....	6.90	7.70	5.30	4.[illegible]5
12	3.70	3.85	4.20	6.55	.....	.....	7.30	.....	9.10	7.25	5.25	4.70
13	3.80	3.75	4.75	6.05	.....	.....	6.30	.....	9.40	7.35	5.25	4.[illegible]
14	3.75	3.70	5.00	6.70	.....	.....	5.50	.....	10.00	7.10	5.25	4.80
15	3.65	3.75	5.05	6.75	.....	.....	6.00	.....	11.10	7.10	5.05	5.30
16	3.50	3.80	5.05	6.80	.....	.....	5.40	.....	11.50	6.75	5.50	4.55
17	3.70	3.90	5.50	6.85	.....	.....	5.50	.....	10.80	6.60	5.25	[illegible]
18	3.70	3.75	5.55	6.75	.....	.....	5.40	.....	10.10	6.60	4.65	[illegible]
19	4.20	3.55	7.90	7.10	.....	5.15	5.15	.....	9.40	6.60	4.75	5.30
20	4.00	3.70	8.35	7.20	.....	5.20	5.55	.....	8.90	6.35	4.85	5.20
21	3.85	3.65	8.30	7.10	.....	5.55	4.65	.....	8.50	6.35	4.75	5.25
22	4.00	3.85	8.00	6.80	.....	5.60	4.90	.....	8.10	6.35	4.55	4.80
23	4.00	3.45	8.25	6.75	.....	6.00	5.40	.....	7.90	6.40	4.60	4.80
24	4.00	3.65	7.50	6.80	.....	6.45	5.10	.....	7.70	6.15	4.70	5.1
25	4.10	3.70	7.35	7.05	.....	6.40	4.65	.....	7.10	6.05	4.90	5.00
26	4.05	3.70	7.00	6.10	.....	5.85	5.10	.....	7.20	6.00	5.35	5.30
27	4.00	3.60	6.65	6.35	.....	5.35	4.10	.....	7.20	5.85	5.25	5.50
28	3.85	3.65	6.05	6.50	.....	5.35	4.50	.....	7.05	5.75	4.85	5.40
29	3.95	.....	6.80	6.85	.....	6.20	5.60	.....	5.40	5.85	4.85	5.50
30	3.90	.....	6.45	6.60	.....	6.75	4.50	.....	6.05	5.95	5.05	5.80
31	3.85	.....	6.70	.....	.....	.....	4.30	.....	.....	5.60	.....	5.60

a Chain gage stolen.

ROCK RIVER DRAINAGE BASIN.

Rock River, with its tributaries, the Pecatonica and Kishwaukee rivers, is one of the most important streams in Illinois. It rises in the southeastern part of Wisconsin, flows south and southwest, and enters the Mississippi just below Rock Island, Ill. This river has much

power already developed along its course, and there are several points at which large water-power plants could be situated. Two stations have been maintained during 1903 by the United States Geological Survey on Rock River—one for a short time at Rockton above the mouth of the Pecatonica and the second at Rockton below the mouth of the Pecatonica. This latter one is still being maintained. A station was maintained on the Catfish River at Madison, Wis., up to August 4, 1903, and gage heights were taken of Lake Mendota at the same place.

The drainage area at the station above the Pecatonica is 3,606 square miles. At the station below the Pecatonica it is 6,150 square miles.

ROCK RIVER BELOW PECATONICA CREEK AT ROCKTON, ILL.

This station was established May 13, 1903, by E. Johnson, jr., assisted by L. R. Stockman. It is located at the village highway bridge, one-half mile from the Chicago, Milwaukee and St. Paul Railroad station, 1 mile below the dam, and three-fourths of a mile below the junction of Pecatonica River with Rock River. There are small islands a short distance above and immediately below the station. The chain gage is located on the first span from the left end of the bridge, on the downstream side. The gage is read twice each day by O. T. Bartholomew. The length from end of weight to marker is 26.45 feet. Discharge measurements are made from the upstream side of the five-span highway bridge to which the gage is attached. The initial point for soundings is the face of the abutment on the left end of the bridge. The channel is straight for 2,000 feet above and 1,000 feet below the station. Both banks are high and will not overflow. The channel is about 565 feet wide between bridge abutments and is broken by four piers. The bed of the stream is composed of small rocks and gravel.

Bench mark No. 1 is a hammered cross on the top stone of the left abutment, about 1 foot from the bridge shoe and 1 foot from the south edge. Its elevation above gage datum is 16.85 feet. Bench mark No. 2 is the top of the west end of the south rail of the railroad track, 250 feet north of the north end of the bridge, at a point where the sidewalk on the west side of the street crosses the track. Its elevation above gage datum is 16.49 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Rock River below mouth of Pecatonica Creek at Rockton, Ill.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 13	L. R. Stockman	2.90	2,522
June 30	A. C. Lootz	2.30	1,591
August 18	L. R. Stockman	4.07	4,611
September 4	F. W. Hanna	4.08	4,607
October 9	do	5.35	7,464
November 9	do	2.85	2,874
December 10	do	2.60	2,384

Mean daily gage height, in feet, of Rock River below Pecatonica Creek at Rockton, Ill., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.50	4.10	4.40	3.70	3.10	2.70
2		2.60		4.30	3.60	3.20	2.80
3		2.90		4.20	3.70	3.20	2.70
4		3.70		4.10	3.50	3.10	2.70
5		3.50		4.00	3.70	3.10	2.80
6		3.40		3.90	3.70	3.00	2.70
7		3.40		3.60	4.70	2.90	2.60
8		3.30		3.60	6.00	2.60	2.60
9		3.00	4.10	4.00	5.40	2.70	2.70
10		3.30	4.00	4.10	5.10	2.60	2.60
11		3.50	3.60	4.30	5.00	2.80	2.70
12		3.90	3.20	4.50	4.70	2.90	2.60
13		4.70	3.20	4.30	4.60	3.20	3.30
14		4.60	3.10	5.00	4.40	3.40	3.30
15		4.10	3.40	5.30	4.40	3.30	3.30
16		3.90	3.70	5.70	4.40	3.30	3.40
17		4.00	4.30	5.90	4.30	3.20	3.20
18		3.80	4.20	6.00	4.30	2.70	3.00
19		5.20	3.80	5.70	4.00	3.00	3.30
20		5.70	3.60	5.30	4.10	2.90	3.30
21		6.20	3.50	5.00	4.00	3.00	3.20
22		6.90	3.40	4.80	4.00	2.90	3.20
23		7.20	3.40	4.60	3.80	2.90	3.20
24		7.00	3.50	4.40	3.80	2.80	3.10
25		6.70	3.40	4.00	3.60	2.80	3.10
26		5.80	3.30	3.90	3.60	2.50	3.20
27		4.60	3.60	3.80	3.50	3.10	3.10
28	2.40	4.60	3.90	4.00	3.40	2.70	3.00
29	2.20	4.10	4.30	3.90	3.30	2.90	3.10
30	2.70	4.20	4.60	3.80	3.30	2.90	3.10
31		4.20	4.40		3.10		3.00

Rating table for Rock River below Pecatonica Creek at Rockton, Ill., from May 13 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.2	1,600	3.5	3,635	4.8	6,180	6.1	9,240
2.3	1,735	3.6	3,815	4.9	6,390	6.2	9,490
2.4	1,875	3.7	3,995	5.0	6,610	6.3	9,740
2.5	2,015	3.8	4,180	5.1	6,830	6.4	9,990
2.6	2,160	3.9	4,365	5.2	7,050	6.5	10,240
2.7	2,305	4.0	4,555	5.3	7,280	6.6	10,490
2.8	2,455	4.1	4,745	5.4	7,510	6.7	10,740
2.9	2,610	4.2	4,940	5.5	7,750	6.8	10,990
3.0	2,770	4.3	5,140	5.6	7,990	6.9	11,240
3.1	2,935	4.4	5,345	5.7	8,240	7.0	11,490
3.2	3,105	4.5	5,550	5.8	8,490		
3.3	3,280	4.6	5,760	5.9	8,740		
3.4	3,455	4.7	5,970	6.0	8,990		

Estimated monthly discharge of Rock River below Pecatonica Creek at Rockton, Ill., for 1903.

[Drainage area, 6,150 square miles.]

Month.	Discharge in second feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
July	11,990	2,015	5,584	0.91	1.05
August 1 and 9–31			3,880	.63	.56
September	8,990	3,815	5,578	.91	1.02
October	8,990	2,935	4,786	.78	.90
November	3,455	2,015	2,712	.44	.49
December	4,180	2,160	2,795	.45	.52

ROCK RIVER ABOVE PECATONICA CREEK NEAR ROCKTON, ILL.

This station was established May 13, 1903, by E. Johnson, jr., assisted by L. R. Stockman. The station, which has since been discontinued, was located on the highway bridge above the mouth of Pecatonica River, about 1 mile from Rockton, Ill., and one-half mile below the dam. The bridge is on a bend in the stream and is at an angle to the thread of the current. A canal takes water from Rock River and discharges it below this station but above the lower station. The chain gage was located on the downstream side of left

span and was read once each day by George W. Blackmar. Discharge measurements were made from the two-span highway bridge, to which the gage was fastened. The face of the abutment at the right end of the bridge was used as the initial point for soundings. Both banks are high and the bed is composed of gravel. The station was discontinued August 18, 1903, on account of being subject to backwater from Pecatonica River and on account of the poor conditions for accurate measurement. No bench marks were established.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Rock River above Pecatonica Creek, near Rockton, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 13	L. R. Stockman	3.90	950
July 2	do	3.00	223

Mean daily gage height, in feet, of Rock River above Pecatonica Creek at Rockton, Ill., for 1903.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1		2.50	5.30	12		5.20	4.10	23	3.20	7.70	
2		2.80	5.20	13		5.20	4.00	24	2.80	7.60	
3		2.20	5.10	14		4.80	3.90	25	2.80	7.50	
4		3.10	4.90	15		4.70	3.90	26	2.90	6.70	
5		3.50	4.90	16		4.60	4.90	27	2.90	6.40	
6		3.90	4.70	17		4.50	4.70	28	3.30	6.20	
7		4.10	4.70	18		5.60	4.60	29	3.20	5.90	
8		4.20	4.80	19		6.80		30	2.50	5.60	
9		4.30	4.20	20		6.70		31		5.40	
10		4.50	4.40	21	3.40	6.90					
11		4.70	4.10	22	2.90	7.40					

CATFISH RIVER AT MADISON, WIS.

This station was established December 18, 1902, by L. R. Stockman. The gage is located on the lower side of the Main Street Bridge. An additional gage was maintained a few blocks away at the outlet of Lake Mendota, in order to keep a record of its water surface. Both gages are plain staffs, graduated to feet and tenths. That on the bridge is nailed to the middle pier. Both gages were read once daily by James Mackin. The channel is straight both above and below the station for over 1,000 feet; it has a width of 55 feet and does not overflow. The bed is of soft material and is overgrown with long grass. The flow is sluggish and is affected by back water from Lake Monona.

Bench mark No. 1, elevation assumed 1,000 feet, is the water table at the northwest corner of Nievuhr's saloon. Bench mark No. 2,

elevation 1,004.46 feet, water table at the west corner of Hausmann's malt house. The 17-foot mark on gage at Main Street Bridge has an elevation of 992.15 feet. The 16-foot mark on gage in Lake Mendota has an elevation of 997.27 feet, or 7.19 feet below bench mark No. 2. The 16-foot mark at the dam is 6.12 feet above the 16-foot mark of Main street gage.

This station was discontinued August 4, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Catfish River at Madison, Wis., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 8	L. R. Stockman	14.20	[a] 53
January 27	do	14.10	60
February 23	do	13.95	58
March 30	do	15.00	197
April 18	do	14.85	174
July 21	E. C. Murphy	15.05	35

[a] Partly frozen.

Mean daily gage height, in feet, of Catfish River at Madison, Wis., for 1902.

Day.	Dec.	Day.	Dec.	Day.	Dec.
18	13.9	23	14.00	28	14.30
19	13.9	24	14.10	29	14.30
20	13.9	25	14.10	30	14.30
21	13.9	26	14.30	31	14.30
22	13 9	27	14.30		

Mean daily gage height, in feet, of Catfish River at Madison, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	14.10	14.00	14.00	15.00	14.80	17	14.80	14.10	15.10	14.90	.....
2	14.10	14.00	14.10	15.00	14.55	18	14.30	14.10	15.20	14.80	.....
3	14.10	14.10	14.10	15.00	14.50	19	14.30	14.10	15.30	14.80	.....
4	14.10	14.30	14.30	15.00	14.50	20	14.30	14.00	15.30	14.80	.....
5	14.10	14.20	14.30	15.00	14.50	21	14.30	14.00	15.20	14.80	.....
6	14.00	14.20	14.30	15.00	14.60	22	14.30	14.00	15.20	14.80	.....
7	14.00	14.20	14.30	14.90	14.60	23	14.30	14.00	15.20	14.80	.....
8	14.00	14.10	14.30	14.90	14.65	24	14.30	14.00	15.20	14.80	.....
9	14.10	14.10	14.60	14.80	14.70	25	14.30	14.00	15.20	14.80	.....
10	14.10	14.10	14.60	14.80	.....	26	14.20	14.00	15.20	14.80	.....
11	14.20	14.10	14.70	14.80	.....	27	14.20	14.00	15.10	14.80	.....
12	14.20	14.10	14.80	14.90	.....	28	14.20	14.00	15.10	14.70	.....
13	14.20	14.00	14.70	14.90	.....	29	14.10	.....	15.10	14.65	.....
14	14.30	14.00	14.80	14.90	.....	30	14.10	.....	15.10	14.65	.....
15	14.30	14.00	14.70	14.90	.....	31	14.10	.....	15.00	.....	.....
16	14.30	14.10	14.70	14.90	.....						

LAKE MENDOTA AT MADISON, WIS.

Mean daily gage height, in feet, of Lake Mendota at Madison, Wis., for 1902.

Day.	Dec.	Day.	Dec.	Day.	Dec.
22	12.3	26	12.5	30	12.5
23	12.3	27	12.5	31	12.5
24	12.4	28	12.5		
25	12.4	29	12.5		

Mean daily gage height, in feet, of Lake Mendota at Madison, Wis., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	12.50	12.30	12.40	12.80	12.50	17	12.30	12.40	12.80	12.70	.....
2	12.50	12.30	12.50	12.80	12.50	18	12.30	12.40	12.80	12.70	.....
3	12.50	12.30	12.50	12.80	12.50	19	12.30	12.40	12.90	12.70	.....
4	12.50	12.30	12.50	12.80	12.50	20	12.30	12.40	13.00	12.70	.....
5	12.50	12.30	12.50	12.70	12.50	21	12.30	12.40	13.00	12.65	.....
6	12.50	12.30	12.50	12.70	12.50	22	12.30	12.40	13.00	12.60	.....
7	12.50	12.30	12.50	12.70	12.45	23	12.30	12.40	13.00	12.60	.....
8	12.50	12.30	12.70	12.70	12.45	24	12.30	12.40	13.00	12.60	.....
9	12.30	12.30	12.80	12.70	12.40	25	12.30	12.40	13.00	12.60	.....
10	12.30	12.30	12.80	12.70	12.40	26	12.30	12.40	13.00	12.55	.....
11	12.30	12.30	12.80	12.70	12.35	27	12.30	12.40	12.90	12.50	.....
12	12.30	12.30	12.80	12.80	12.30	28	12.30	12.40	12.90	12.50	.....
13	12.30	12.30	12.80	12.80	12.30	29	12.30	.....	12.90	12.50	.....
14	12.30	12.40	12.80	12.80	12.30	30	12.30	.....	12.90	12.50	.....
15	12.30	12.40	12.80	12.80	12.25	31	12.30	.....	12.80	.....	.....
16	12.30	12.40	12.80	12.70	12.25						

ILLINOIS RIVER DRAINAGE BASIN.

Illinois River is formed by the Desplaines and Kankakee rivers, which unite about 4 miles below the point where Dupage River enters the Desplaines. The principal tributaries to these rivers are Vermilion River, which enters the Illinois proper a short distance below Lasalle; Sangamon River; Dupage River, which enters the Desplaines below Joliet; Mazon River, which enters the Illinois near Morris; and Fox River. The following list gives the stations at which measurements were made during 1903: Illinois River at Peoria, Illinois River at Lasalle, Illinois River at Ottawa, Fox River at Ottawa, Illinois River near Seneca, Illinois River near Minooka, Desplaines River near Channahon, Desplaines River above mouth of Jackson Creek near Channahon, and the Sangamon near Springfield.

The drainage areas at the points where stations have been maintained are as follows:

Drainage areas in Illinois basin at gaging stations.

ILLINOIS RIVER.

	Square miles.
Peoria	13,249
Lasalle	11,714
Minooka	6,476
Ottawa	10,094
Seneca	7,508

DESPLAINES RIVER.

Jackson Creek	1,172
Kankakee Cut-off	1,489

FOX RIVER.

Ottawa	2,492

SANGAMON RIVER AT SPRINGFIELD, ILL.

A station was established on Sangamon River at Springfield on the bridge of the Chicago, Peoria and St. Louis Railroad, which crosses the stream 1½ miles north of the State Fair Grounds. This bridge was not fully adapted for use as a measuring station, but was the best that could be found. It was found, however, that the station was poorer than expected and was finally abandoned. The drainage area at this point is 2,860 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Sangamon River at Springfield, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 11	E. H. Heilbron	+3.05	4,790
July 4	do	−3.90	543

Mean daily gage height, in feet, of Sangamon River at Springfield, Ill., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		−1.50		−2.45		17	(a)	−1.93			−1.65
2		−1.50		−2.55	−4.34	18	(a)	−2.30			−1.63
3				−2.90	−4.05	19		−2.75			−1.90
4				−3.90	−4.05	20		−3.13			−2.60
5				−2.55	−4.05	21		−2.58			−3.10
6				−2.55	−4.05	22		−2.05			−4.40
7				−2.57	−4.05	23		−2.08			
8				−2.60	−4.05	24		−2.58			
9				−2.60	−4.10	25		−3.03			
10				−2.60	−4.10	26	−1.45	−3.15			
11	3.05			−2.65	−4.10	27	−1.45	−3.30			
12	5.61				−4.05	28	−1.45		−2.45		
13	5.51				−4.05	29	−1.50		−2.35		
14	6.21	− .75			−4.15	30	−1.50		−2.20		
15	6.76	−1.05			−4.15	31					
16	6.76	−1.38			−1.90						

[a] Water over gage.

ILLINOIS RIVER NEAR PEORIA, ILL.

This station was originally established by Jacob Harmon. It was reestablished March 10, 1903, by E. H. Heilbron. It is located on the

Peoria and Pekin Union Railroad bridge over the Illinois River, 1½ miles southwest of Peoria, Ill., and can be reached by street cars. The gage is a plain staff graduated to feet and inches and fastened to the central pier of the bridge. It is read twice daily by the draw tender of the bridge, P. A. Blumb. The measurements are taken from the bridge, and the initial point for sounding is on the right bank. The river is straight for 3,000 feet above and 2,000 feet below the station and has a width of about 1,000 feet, broken by six piers. The section is deep and the flow sluggish. The bed of the stream is composed of gravel and silt. The right bank is high, and the railroad embankment is along this shore. The left bank is low and liable to overflow.

The bench mark is the southwest corner of the top stone of the west abutment of the bridge; elevation, 125.722 feet below the Chicago datum. The gage at this point has for its zero a point 153.814 feet below the Chicago city datum. The gage reads up from this point, and in order to obtain the height of the river, referred to the Chicago datum, it is necessary to subtract the gage reading from 153.814 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Illinois River near Peoria, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 18	E. H. Heilbron	17.58	41,219
April 3	do	15.23	25,839
April 29	do	15.50	26,079
May 13	do	12.67	15,357
July 5	do	9.33	9,424
August 22	E. Johnson, jr	8.40	8,713
September 25	Johnson and Hanna	11.92	15,154
October 23	F. W. Hanna	10.83	13,686
November 12	do	9.00	9,135

Mean daily gage height, in feet, of Illinois River near Peoria, Ill., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		15.50	15.00	11.17	9.00		9.00	11.25	10.08	8.58
2		15.08	14.75	11.50	9.08		8.92	11.21	10.08	8.58
3		15.17	15.08	11.75	9.00		8.83	11.00	10.00	8.58
4		14.92	14.75	10.25	8.92		8.83	11.04	9.92	8.56
5		14.42	14.67	10.33	8.75		8.83	11.08	9.92	8.50
6		14.50	14.33	10.58	8.67		8.75	10.92	9.88	8.50
7		14.58	14.17	10.33	8.58		8.67	10.92	9.71	8.42

Mean daily gage height, in feet, of Illinois River, etc.—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8		14.67	14.00	10.17	8.67		8.58	11.12	9.50	8.42
9		14.58	13.83	9.83	(a)		8.50	11.25	9.33	8.46
10	18.16	14.58	13.50	9.67			9.00	11.37	9.33	8.50
11	18.33	14.50	13.58	9.58			9.08	11.42	9.25	8.58
12	18.50	14.92	13.33	9.58			9.17	11.42	9.17	8.67
13	18.42	15.17	12.92	9.33			9.42	11.42	9.33	8.92
14	18.42	16.58	12.75	9.25			9.58	11.37	9.33	8.83
15	18.25	16.25	12.67	9.17			10.17	11.29	9.33	8.75
16	18.08	17.25	12.42	9.08			10.42	11.21	9.33	8.67
17	17.83	17.67	12.25	8.08			10.33	11.21	9.17	8.75
18	17.50	17.92	12.17	8.25			11.67	11.12	9.08	8.75
19	17.33	18.00	11.83	8.25			11.92	11.00	9.00	8.88
20	17.58	17.92	11.50	8.25			12.17	11.00	8.88	8.96
21	17.42	17.83	11.33	8.67			12.25	10.87	8.79	9.04
22	17.58	17.50	11.25	8.67		8.33	12.25	10.83	8.75	9.25
23	17.58	17.33	11.08	8.67		8.25	12.25	10.83	8.79	9.37
24	17.42	17.00	11.00	8.50		8.25	12.17	10.62	8.83	9.46
25	17.33	16.67	10.92	8.33		8.17	11.92	10.58	8.92	9.46
26	17.17	16.33	10.83	8.50		8.17	11.67	10.58	8.00	9.83
27	16.92	16.00	10.83	8.42		8.33	11.80	10.42	8.17	9.96
28	16.58	15.75	10.75	8.50		8.67	11.62	10.33	8.25	10.00
29	16.33	15.42	10.58	8.92		8.92	11.46	10.25	8.75	10.08
30	16.00	15.33	10.75	9.00		9.00	11.37	10.21	8.67	10.08
31	15.67		10.00			9.00		10.17		10.08

[a] Readings from July 9 to August 21 not taken.

Rating table for Illinois River near Peoria, Ill., from March 10 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
8.0	7,850	9.3	9,955	11.2	13,645	13.8	20,415
8.1	8,000	9.4	10,130	11.4	14,080	14.0	21,060
8.2	8,150	9.5	10,310	11.6	14,525	14.5	22,830
8.3	8,305	9.6	10,490	11.8	14,985	15.0	24,900
8.4	8,460	9.7	10,670	12.0	15,455	15.5	27,450
8.5	8,620	9.8	10,855	12.2	15,940	16.0	30,690
8.6	8,780	9.9	11,040	12.4	16,440	16.5	34,040
8.7	8,940	10.0	11,230	12.6	16,955	17.0	37,390
8.8	9,105	10.2	11,610	12.8	17,490	17.5	40,740
8.9	9,270	10.4	12,000	13.0	18,035	18.0	44,090
9.0	9,440	10.6	12,400	13.2	18,600	19.0	50,790
9.1	9,610	10.8	12,805	13.4	19,185		
9.2	9,780	11.0	13,220	13.6	19,790		

Estimated monthly discharge of Illinois River near Peoria, Ill., for 1903.

[Drainage area, 13,249 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 10–31			40,589	3.06	2.50
April	44,090	22,830	31,169	2.35	2.62
May	25,360	11,230	17,332	1.31	1.51
June	14,870	8,000	10,152	.77	.86
July 1–8 [a]			9,160	.69	.21
August 22–31 [a]			8,637	.65	.24
September	16,065	8,620	12,127	.92	1.03
October	14,080	11,565	13,129	.99	1.14
November	11,420	7,850	9,790	.74	.83
December	11,420	8,460	9,500	.72	.83

[a] Readings July 9 to August 21 not taken.

ILLINOIS RIVER NEAR LASALLE, ILL.

This station was established November 13, 1902, by E. H. Heilbron. It is located on the highway bridge at Shipping Sport, 1½ miles southeast of the Chicago, Rock Island and Pacific Railroad depot, Lasalle, Ill., 3,000 feet below the Chicago, Burlington and Quincy Railroad bridge, 1 mile below Big Vermilion River, 3,500 feet below Little Vermilion River, and 1 mile above Peru, Ill.

There is a plain staff graduated to feet and tenths and fastened to the southwest corner of the south pier of the bridge. A standard chain gage was installed May 12, 1903, reading the same as the original vertical gage. Gage heights are read twice daily by James Desper. Discharge measurements are made from the floor of the bridge. The initial point for soundings is a cross cut on the truss at the south end of the bridge on the east side of the railing. The width of the channel is about 750 feet, broken by five piers, and the maximum depth at ordinary stages is 14 to 26 feet. The bed is mostly of a firm material and the flow is sluggish at low stages. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below the station. The right bank is low and is overflowed at extreme high water. The left bank is high.

Bench mark No. 1 is at the east end of the north abutment on the third stone step from the east wing wall. It is a square marked "U. S." cut in the stone; elevation, 114.704 feet below the Chicago datum. Bench mark No. 2 is at the east end of the south pier and is a square marked "U. S." cut in the stone; elevation, 113.243 feet below the Chicago datum. The gage is set with its zero at the same

elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Mean daily gage height, in feet, of Illinois River near Lasalle, Ill., for 1903.

Day.	Mar.	Apr.	May.	July.	Aug.	Sept.
1		−133.03	−133.75		−139.50	−139.20
2		133.28	−133.85		−139.58	−139.30
3		−133.45	−133.95		−139.68	−139.30
4		−133.60	−134.30		−139.73	−139.50
5		−132.20	−134.87		−139.35	−139.60
6		−133.77	−135.15		−139.05	−139.60
7		−133.65	−135.45		−138.85	−139.80
8		−133.86	−135.75	−139.80	−138.70	−139.80
9		−133.28	−135.95	−139.80	−139.00	−139.80
10		−132.72	−136.18	−139.80	−139.20	−139.00
11		−132.50	−136.30	−139.40	−139.30	−138.40
12		−130.25	−136.25	−139.28	−139.50	−138.20
13		−129.72	−136.65	−139.32	−139.70	−138.50
14		−128.87	−136.85	−139.48	−139.70	−138.30
15		−129.55	−137.03	−139.58	−139.70	
16		−127.50	−137.14	−139.68	−139.20	
17		−127.70	−137.45	−139.78	−139.40	
18		−128.15	−137.55	−139.00	−139.60	
19		−128.50	−137.65	−138.30	−139.80	
20		−129.00	137.90	138.30	−139.80	
21		−129.54	−138.05	−138.75	−139.90	
22		−130.25	−137.97	−139.10	−139.90	
23		−130.28	138.04	−139.30	−140.03	
24		−131.10		139.50	−140.03	
25		−131.70		−139.60	−139.90	
26		−131.90		−139.80	−140.10	
27		−132.20		139.90	−139.70	
28		−132.50		−139.90	−139.00	−137.10
29	131.90	−132.85		−139.80	−138.70	−137.20
30		−133.30		−139.60	−138.90	−137.40
31				−139.60	−139.08	

Discharge measurements of Illinois River near Lasalle, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 17	E. H. Heilbron	−129.70	32,006
April 4	do	−133.60	17,638
April 28	do	−132.55	17,884
May 12	do	−136.50	11,110
July 7	do	−139.85	7,221
July 15	E. C. Murphy	−139.55	8,123
August 23	E. Johnson, jr	−140.03	7,448

Rating table for Illinois River near Lasalle, Ill., from April 1 to September 30, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−140.0	7,400	−138.7	8,320	−136.8	10,570	−134.2	15,290
−139.9	7,465	−138.6	8,405	−136.6	10,850	−134.0	15,750
−139.8	7,530	−138.5	8,495	−136.4	11,140	−133.5	16,940
−139.7	7,595	−138.4	8,590	−136.2	11,440	−133.0	18,400
−139.6	7,660	−138.3	8,690	−136.0	11,750	−132.5	20,180
−139.5	7,725	−138.2	8,795	−135.8	12,070	−132.0	22,060
−139.4	7,795	−138.1	8,905	−135.6	12,410	−131.5	24,000
−139.3	7,865	−138.0	9,020	−135.4	12,760	−131.0	26,190
−139.2	7,935	−137.8	9,260	−135.2	13,140	−130.0	30,790
−139.1	8,010	−137.6	9,500	−135.0	13,550	−129.5	33,090
−139.0	8,085	−137.4	9,760	−134.8	13,970	−129.0	35,390
−138.9	8,160	−137.2	10,020	−134.6	14,410		
−138.8	8,240	−137.0	10,290	−134.4	14,850		

Estimated monthly discharge of Illinois River near Lasalle, Ill., for 1903.

[Drainage area, 11,714 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April [a]	42,290	16,095	25,527	2.18	2.43
May 1 to 23 [b]			11,636	.99	.85
July 8 to 31			7,786	.66	.59
August 1-31	8,320	7,370	7,759	.66	.76
September, 17 days [c]			8,346	.71	.45

[a] April 27, 28, and 30, discharge estimated.
[b] May 2 and 18, discharge estimated.
[c] September 15 to 27, missing.

ILLINOIS RIVER AT OTTAWA, ILL.

This station was established November 11, 1902, by E. H. Heilbron. It is located at the Chicago, Burlington and Quincy Railroad bridge, 2,500 feet below the mouth of Fox River and 200 feet below the highway bridge leading to the main street of Ottawa, Ill. A vertical gage graduated to feet and tenths is fastened to the west end of the first pier from the north abutment of the railroad bridge. A standard

chain gage was established November 1, 1903, to replace the old vertical gage and was made to read the same as the original gage. The length of chain from the end of the weight to the marker was 37.42 feet. The gage was read twice each day by D. C. Woods. Discharge measurements were made from the east side of the railroad bridge, to which the gage is attached. The initial point for soundings was the center one of the group of nails driven into the cap at the south end of the trestlework, south of the main bridge structure. The channel is straight for about 2,000 feet above and below the station and has a width between abutments of 650 feet, broken by four piers. The depth at ordinary stages is about 13 feet. The railroad embankments form part of the banks of this river. The bed of the stream is composed of gravel, which is somewhat shifting. The flow is somewhat sluggish at low stages.

Bench mark No. 1 is the top of the coping stone at the east end of the first pier from the north end of the railroad bridge. The point is marked "U. S." Its elevation is 48.638 feet below the Hennepin datum and 103.156 feet below the Chicago datum. Bench mark No. 2 is a cut in the batter on the coign, 3 feet above ground, at the west end of the south pier of the railroad bridge. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Illinois River at Ottawa, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 18	E. H. Heilbron	−122.98	30,885
April 5	do	−126.25	17,573
April 28	do	−126.07	18,340
May 12	do	−128.42	11,616
July 8	do	−129.54	7,541
August 23	E. Johnson, jr	−129.57	7,668
September 25	Johnson and Hanna	−128.35	11,592
October 12	Johnson and Hanna	−127.88	13,543
November 12	F. W. Hanna	−129.01	8,898
December 12	do	−126.42	[a] 6,822

[a] Ice jam.

Mean daily gage height, in feet, of Illinois River at Ottawa, Ill., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		(a)	−126.90	−127.58	−129.62	−129.00	−128.90	−128.60	−128.63	−129.05
2		(a)	−127.22	−127.65	−129.62	−129.03	−129.00	−128.60	−128.68	−129.05
3		−126.65	−127.32	−128.03	−129.60	−129.16	−129.20	−128.60	−128.77	−129.05
4		−126.61	−127.47	−128.03	−129.56	−129.10	−129.20	−127.93	−128.82	−129.09
5		−126.10	−127.58	−127.55	−129.55	−128.80	−129.30	−128.10	−128.85	−129.13
6		−125.47	−127.77	−126.50	−129.55	−128.55	−129.35	−128.12	−128.88	−128.95
7		−125.28	−128.07	−126.50	−129.50	−128.39	−129.38	−127.77	−128.95	−128.95
8		−125.75	−128.20	−126.80	−129.54	−128.54	−129.98	−127.67	−129.09	−127.82
9		−125.82	−128.30	−127.20	−129.45	−128.80	−129.44	−127.70	−129.13	−128.30
10		−126.65	−128.30	−127.64	−129.35	−128.90	−128.68	−127.77	−129.15	−128.60
11	−120.35	−124.60	−128.32	−128.00	−129.00	−129.00	−128.00	−127.89	−129.13	−127.00
12	−120.90	−121.98	−128.42	−128.33	−129.00	−129.10	−128.35	−127.97	−129.10	−126.95
13	−121.68	−121.58	−128.49	−128.52	−129.10	−129.20	−128.58	−128.05	−129.18	−126.52
14	−121.70	−120.48	−128.60	−128.75	−129.20	−129.30	−128.35	−128.10	−129.28	−126.75
15	−121.92	−119.08	−128.74	−129.00	−129.20	−129.10	−125.45	−128.12	−129.33	−126.45
16	−122.50	−119.42	−128.85	−129.25	−129.26	−128.65	−124.08	−128.16	−129.40	−126.32
17	−122.95	−120.88	−129.03	−129.40	−129.31	−128.80	−124.75	−128.20	−129.40	−126.75
18	−123.25	−122.02	−129.05	−129.10	−128.20	−129.10	−125.85	−128.26	−129.39	−127.08
19	−123.50	−122.02	−129.10	−129.00	−127.90	−129.20	−126.48	−128.33	−129.34	−127.10
20	−121.45	−122.65	−129.17	−129.03	−128.10	−129.30	−126.84	−128.33	−129.30	−127.12
21	−120.72	−123.37	−129.15	−129.10	−128.50	−129.30	−127.38	−128.25	−129.29	−126.80
22	−122.15	−124.05	−129.93	−129.25	−128.50	−129.50	−127.58	−128.28	−129.13	−127.40
23	−122.75	−124.57	−128.95	−129.13	−129.10	−129.50	−127.80	−128.39	−128.70	−126.78
24	−123.37	−125.10	−128.85	−129.22	−129.20	−129.60	−128.04	−128.43	−128.73	−126.60
25	−124.20	−125.45	−128.82	−129.33	−129.30	−129.50	−128.03	−128.49	−129.00	−126.75
26	−124.68	−125.75	−128.68	−129.48	−129.30	−129.40	−128.50	−128.50	−129.48	−126.98
27	−125.02	−125.95	−128.50	−129.46	−129.40	−129.20	−128.40	−128.50	−129.28	−127.06
28	−125.25	−126.10	−128.30	−129.57	−129.40	−128.60	−128.50	−128.52	−129.21	−127.22
29	−125.62	−126.37	−128.02	−129.65	−129.30	−128.70	−128.40	−128.58	−129.12	−127.30
30	−126.52	−126.65	−128.05	−129.66	−129.00	−128.70	−128.47	−128.60	−129.20	−127.28
31	−126.82		−127.78		−129.00	−128.80		−128.61		−127.22

a Gage out.

Rating table for Illinois River at Ottawa, Ill., from March 11 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−130.0	6,740	−128.7	9,730	−126.8	15,620	−124.2	25,990
−129.9	6,940	−128.6	9,995	−126.6	16,340	−124.0	26,810
−129.8	7,145	−128.5	10,265	−126.4	17,080	−123.5	28,860
−129.7	7,355	−128.4	10,540	−126.2	17,840	−123.0	30,910
−129.6	7,570	−128.3	10,820	−126.0	18,620	−122.5	32,960
−129.5	7,790	−128.2	11,105	−125.8	19,430	−122.0	35,010
−129.4	8,015	−128.1	11,395	−125.6	20,250	−121.5	37,060
−129.3	8,245	−128.0	11,690	−125.4	21,070	−121.0	39,110
−129.2	8,480	−127.8	12,295	−125.2	21,890	−120.5	41,160
−129.1	8,720	−127.6	12,920	−125.0	22,710	−120.0	43,210
−129.0	8,965	−127.4	13,565	−124.8	23,530	−119.0	47,310
−128.9	9,215	−127.2	14,230	−124.6	24,350		
−128.8	9,470	−127.0	14,920	−124.4	25,170		

Estimated monthly discharge of Illinois River at Ottawa, Ill., for 1903.

[Drainage area, 10,094 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 11-31	41,775	15,620	30,111	2.98	2.33
April	46,900	15,800	25,589	2.54	2.83
May	15,270	6,840	10,700	1.06	1.22
June	16,710	7,465	10,419	1.03	1.15
July	11,990	7,570	8,657	.86	.99
August	10,540	7,570	8,922	.88	1.01
September	26,400	6,740	12,106	1.20	1.34
October	12,760	9,995	11,015	1.09	1.26
November	9,860	7,790	8,722	.86	.96
December	17,460	8,600	13,563	1.34	1.54

FOX RIVER AT OTTAWA, ILL.

This station was established November 10, 1902, by E. H. Heilbron. It was located at the Main street highway bridge over Fox River at Ottawa, Ill. The gage is a plain staff fastened to the abutment of the bridge, graduated to feet and tenths, and was read twice daily by D. C. Woods. The measurements were taken from the bridge. The channel is straight for 300 feet above and 600 feet below the station. The banks are both high. The bed of the stream is rock and gravel. The bench mark is the top step of the east concrete abutment of the street railway bridge over Fox River at Main street, Ottawa, Ill. It is on the south wing wall at the south end of the parapet wall. Elevation 99.940 feet below the Chicago city datum, and 51.854 feet above the Hennepin datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was discontinued in May, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Fox River at Ottawa, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 17	E. H. Heilbron	−122.85	3,519
April 5	do	−125.65	3,488

Mean daily gage height, in feet, of Fox River at Ottawa, Ill., for 1903.

Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.	Day.	Mar.	Apr.
1		(a)	9		−125.82	17	−122.95		25	−123.75	
2		(a)	10		−126.25	18	−123.25		26	−124.28	
3		−126.00	11	−119.50	−124.10	19	−123.50		27	−124.60	
4		−126.01	12	−120.50		20	−121.45		28	−124.88	
5		−125.62	13	−120.90		21	−120.68		29	−125.25	
6		−125.10	14	−121.40		22	−121.62		30	−125.95	
7		−124.92	15	−121.92		23	−122.25		31	−126.35	
8		−125.35	16	−122.50		24	−122.93				

a Gage out of order.

ILLINOIS RIVER NEAR SENECA, ILL.

This station was established November 9, 1902, by E. H. Heilbron. It is located at the Kansas and Southern Railroad bridge, 2 miles from Seneca, Ill. The gage is a vertical staff graduated to feet and tenths and fastened to the center pier of the bridge. It was read twice daily by Augusta Ebeling. The measurements are taken from the bridge. The initial point for sounding is on the left bank. The channel is straight both above and below the station and has a width of about 360 feet at low water and 560 feet at high water. The maximum depth at ordinary stages is 20 feet, and the flow is moderately rapid. Both banks of the stream are high. The bed of the stream is composed of gravel and silt. The bench mark is a cut in the southwest corner of the south abutment of the Kansas and Southern Railroad bridge marked ⊙ S. D. B. M. Elevation, 77.220 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established to show the discharge of Mazon River, which enters the Illinois a short distance above the station. It was discontinued August 22, 1903.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following discharge measurement was made by E. H. Heilbron.

March 16: Gage height, 94.23 feet; discharge, 24,372 second-feet.

Mean daily gage height, in feet, of Illinois River near Seneca, Ill., for 1903.

Day.	Mar.	Apr.	May	June	July	Aug.
1		−97.72	−98.10	−98.38	−99.91	−99.60
2		−97.90	−98.21	−98.34	−99.87	−99.95
3		−98.00	−98.19	−98.53	−99.90	−99.78
4		−97.76	−98.39	−98.46	−99.87	−99.43
5		−96.96	−98.50	−98.11	−99.80	−99.40
6		−96.25	−98.60	−97.24	−99.80	−99.25
7		−96.18	−98.80	−97.05	−99.90	−99.00
8		−96.68	−98.87	−97.48	−99.90	−99.20
9		−96.98	−98.90	−97.78	−99.90	−99.35

Mean daily gage height, in feet, of Illinois River, etc.—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.
10	91.20	97.32	98.90	98.18	99.70	99.53
11	91.70	96.58	98.97	98.48	99.30	99.63
12	92.20	93.25	99.04	98.73	99.46	99.76
13	93.62	93.15	99.11	98.95	99.62	99.91
14	93.10	92.05	99.16	99.09	99.63	99.85
15	93.64	90.35	99.27	99.18	99.68	99.93
16	94.30	90.40	99.42	99.34	99.76	99.93
17	94.72	91.55	99.50	99.50	99.81	99.99
18	95.15	92.22	99.55	99.56	99.40	100.05
19	95.46	93.03	99.62	99.58	98.75	100.20
20	95.47	94.06	99.64	99.48	99.04	100.10
21	93.70	94.96	99.63	99.47	99.33	100.55
22	99.05	95.55	99.42	99.51	99.54	100.50
23	94.55	95.59	99.45	99.50	99.65	101.00
24	95.20	96.51	99.31	99.60	99.73	101.00
25	95.70	96.70	99.26	99.68	99.82	101.00
26	96.20	96.95	99.03	99.78	99.87	101.50
27	96.50	97.08	98.96	99.81	99.90	.....
28	96.83	97.20	98.60	99.85	99.86	.....
29	99.05	97.57	98.55	99.90	99.92	.....
30	97.22	97.77	98.67	99.91	99.83	.....
31	97.43	.....	98.50	.....	99.56	.....

ILLINOIS RIVER NEAR MINOOKA, ILL.

This station was established November 7, 1902, by E. H. Heilbron, to determine the flow of Kankakee River. It is 1 mile northwest of Devine, Ill., 6 miles south of Minooka, Ill., and 2½ miles west of the mouth of Kankakee River. The gage is a vertical rod fastened to the center pier of the bridge. It is read twice daily by J. A. Lyons. Discharge measurements are made from the bridge and from a boat and cable about 25 feet above the bridge. The initial point for soundings is an oak hub about 4 feet north of the north side of the railroad pumping station. The channel is straight for 1,000 feet above the station and 2,000 feet below. The width at ordinary stages is 560 feet, with a maximum depth of 12 feet. The flow is moderately rapid, but is sluggish at low stages. The width at high water is about 1,000 feet. The right bank is low and liable to overflow; the left bank is high. The bed of the stream is of gravel and is shifting on the north side.

The bench mark is a cut in the stone on the south abutment of the Elgin, Joliet and Eastern Railroad bridge. It is marked S. D. ⊡P. B. M. Its elevation is 85.030 feet above the Hennepin datum and 66.764 feet below the Chicago city datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Illinois River near Minooka, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 15	E. H. Heilbron	−86.84	25,689
April 19	do	−91.12	13,482
May 10	do	−94.10	7,393
July 12	do	−93.83	7,465
August 31	do	−93.99	7,044
September 26	Johnson and Hanna	−94.10	7,319
October 24	do	−94.10	7,673
November 11	F. W. Hanna	−94.15	7,596

Mean daily gage height, in feet, of Illinois River near Minooka, Ill., for 1903.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	−90.62		−91.86	−91.77	−92.63	−94.48	−93.12	−94.29	−94.20	−93.92	−93.98
2	−89.87		−92.05	−91.96	−92.69	−94.34	−93.98	−94.40	−94.17	−93.85	−93.83
3	−89.65		−92.13	−92.02	−92.91	−94.30	−94.13	−94.32	−94.25	−94.09	−93.78
4	−89.72		−91.91	−92.23	−92.78	−94.34	−94.07	−94.44	−94.12	−94.14	−93.71
5	−89.25		−90.85	−92.36	−92.19		−93.63	−94.45	−93.90	−94.21	−94.30
6	−89.38		−89.60	−92.60	−91.04	−94.30	−93.24	−94.67	−93.87	−94.18	−93.60
7	−87.45		−89.85	−92.95	−91.07	−94.36	−93.08	−94.63	−93.83	−94.22	−93.58
8			−90.62	−93.00	−91.36	−94.32	−93.55	−94.64	−93.61	−94.25	−93.68
9	−82.98		−91.05	−92.99	−91.83	−94.20	−92.70	−94.60	−93.36	−94.25	−93.88
10	−83.58		−91.36		−92.33	−93.69	−93.84	−94.09	−93.37	−94.15	−93.92
11	−84.18		−87.80	−93.12	−92.67	−93.58	−94.00	−93.39		−94.13	−93.79
12	−84.69		−86.13		−93.04	−93.86	−94.23	−94.11		−94.20	−93.72
13	−85.20		−85.78	−93.31	−93.26	−93.90	−94.30	−94.26		−94.23	−92.42
14	−85.64		−84.02	−93.46	−93.43	−93.97	−94.30	−94.00	−93.75	−94.27	−92.20
15		−86.62	−82.89	−93.55	−93.48	−94.05	−94.18	−92.79	−93.83	−94.88	−91.84
16		−87.33	−83.31	−93.76	−93.79	−94.17	−94.45	−90.36	−93.78	−94.22	−92.94
17		−88.03	−83.87	−93.85	−93.98	−94.26	−94.53	−90.99	−93.88	−94.20	−92.68
18		−88.37	−84.75	−93.84	−93.98	−92.85	−94.65	−91.78	−93.83	−94.43	−92.86
19		−88.78	−85.84	−93.94	−94.03	−92.80	−94.65	−92.12	−93.98	−94.45	−92.68
20		−88.35	−86.77	−93.95	−94.00	−93.47	−94.55	−92.53	−93.93	−94.20	−90.84
21		−86.95	−87.55	−93.97	−94.11	−94.04	−94.58	−93.01	−93.83	−94.41	−90.93
22		−87.22	−88.75	−93.78	−94.05		−94.61	−93.82	−93.91	−93.52	−90.84
23		−87.72	−89.26	−93.79	−94.05	−94.05	−94.56	−93.56	−93.93	−93.36	−91.00
24		−88.45	−89.73	−93.62	−94.13	−94.12	−94.51	−93.73	−93.97	−93.42	−90.84
25		−89.25	−90.10	−93.43	−94.22	−94.32	−94.53	−93.89	−94.06	−94.20	−90.83
26		−89.89	−90.41	−93.19	−94.27	−94.38	−94.64	−94.03	−93.98	−94.23	−91.31
27		−90.30	−90.46	−93.52	−94.34	−94.29	−94.48	−94.00	−93.95	−94.05	−91.18
28		−90.72	−90.63	−92.47	−94.37	−94.33	−93.94	−94.10	−93.98	−94.10	−91.13
29		−91.00	−91.18	−92.57	−94.39	−94.30	−94.05	−94.10	−94.05	−94.33	−91.10
30		−91.27	−91.42	−92.71	−94.40	−94.21	−94.30	−94.20	−94.01	−93.98	−91.30
31		−91.50		−92.78		−93.65	−94.23		−93.99		−91.04

Rating table for Illinois River near Minooka, Ill., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−95.0	6,020	−93.7	7,840	−91.8	11,765	−88.0	22,275
−94.9	6,135	−93.6	8,010	−91.6	12,260	−87.5	23,700
−94.8	6,250	−93.5	8,185	−91.4	12,765	−87.0	25,125
−94.7	6,370	−93.4	8,365	−91.2	13,280	−86.5	26,550
−94.6	6,495	−93.3	8,550	−91.0	13,810	−86.0	27,975
−94.5	6,625	−93.2	8,740	−90.8	14,350	−85.5	29,400
−94.4	6,760	−93.1	8,930	−90.6	14,895	−85.0	30,825
−94.3	6,900	−93.0	9,125	−90.4	15,450	−84.5	32,250
−94.2	7,045	−92.8	9,525	−90.2	16,010	−84.0	33,675
−94.1	7,195	−92.6	9,940	−90.0	16,575	83.0	36,525
−94.0	7,350	−92.4	10,375	−89.5	18,000	82.0	39,375
−93.9	7,510	−92.2	10,820	−89.0	19,425		
−93.8	7,675	−92.0	11,285	−88.5	20,850		

Above −90 feet gage height the curve becomes a tangent, with difference of 285 second-feet per tenth gage height.

Estimated monthly discharge of Illinois River near Minooka, Ill., for 1903.

[Drainage area, 6,476 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 1–14 [a]	36,525	14,895	25,238	3.90	2.03
February					
March 15–31			19,670	3.04	1.92
April	36,810	10,935	20,244	3.13	3.49
May [b]	11,885	7,430	8,979	1.39	1.60
June	13,675	6,760	8,754	1.35	1.51
July [c]	9,525	6,625	7,323	1.13	1.30
August	9,730	6,430	7,219	1.11	1.28
September	15,590	6,430	8,190	1.26	1.41
October [d]	8,445	6,970	7,572	1.17	1.35
November	8,445	6,135	7,161	1.10	1.23
December	14,215	6,900	10,557	1.63	1.88

[a] January 8, discharge estimated.
[b] May 10 and 12, discharge estimated.
[c] July 5 and 22, discharge estimated.
[d] October 11, 12, and 13, discharge estimated.

DESPLAINES RIVER ABOVE THE MOUTH OF KANKAKEE RIVER NEAR CHANNAHON, ILL.

This station was established October 24, 1902, by E. H. Heilbron. It is located just above the mouth of the Kankakee cut-off, and 2 miles below the mouth of Dupage River, near Channahon, Ill. The gage is a plain staff graduated to feet and tenths and nailed to a tree. It is read twice daily by E. A. Hines. The measurements are taken from a cable and boat. The initial point for sounding is on the left bank. The channel is straight for a thousand feet above the station and slightly curved for a thousand feet below, and has a width of 360 feet, and maximum depth of 20 feet at ordinary stage. The flow is moderately rapid. The right bank is high and rocky, and the Illinois and Michigan Canal runs along the bank. The left bank is high, and the Kankakee cut-off enters the river just below the gaging station. The bed of the stream is gravel and silt.

Bench mark No. 1 is a nail driven into the north side of an elm tree about 2 inches in diameter, on the Illinois and Michigan Canal tow-path, 150 feet north of the Kankakee cut-off. Elevation, 81.501 feet above the Hennepin datum and 70.293 feet below the Chicago city datum. Bench mark No. 2 is a nail in the east root of an elm tree on the east bank of Desplaines River, 50 feet east of the water edge and 200 feet north of the Kankakee cut off, opposite the point where the Illinois and Michigan Canal and Desplaines River are separated. Elevation, 74.204 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum.

This station was established in order to determine the flow of Dupage River.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Desplaines River above mouth of Kankakee River near Channahon, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 14	E. H. Heilbron	−83.59	8,649
April 9	do	−86.61	5,483
April 26	do	−86.10	6,139
May 9	do	−86.93	5,078
July 11	do	−86.75	5,713
August 30	do	−86.75	5,753
September 26	do	−86.55	5,621
October 28	F. W. Hanna	−86.70	5,790
November 25	do	−86.95	5,138
December 17	E. H. Heilbron	−85.60	[a] 6,956

[a] Partly frozen.

Mean daily gage height, in feet, of Desplaines River above mouth of Kankakee River near Channahon, Ill., for 1903.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	-80.20	.....	86.12	-86.95	-86.65	-87.05	86.79	-86.84	-86.84	-86.75	-86.45
2	-85.20	.....	-86.30	-86.95	86.73	-86.84	-86.88	86.78	86.78	-86.56	-86.50
3	85.18	.....	-86.35	86.80	-86.78	86.82	86.86	-86.86	86.88	-86.81	86.40
4	-85.18	.....	-86.53	86.95	86.70	86.98	-86.60	-86.76	-86.67	-86.95	86.38
5	-85.15	.....	-86.35	-86.95	-86.48	-87.01	86.68	-86.83	-86.56	-86.97	87.05
6	-85.15	.....	-86.02	-86.95	86.40	-86.98	-86.97	-87.25	-86.73	-86.88	87.12
7	.....	.....	-86.05	-87.08	86.56	-86.95	-86.17	87.04	-86.55	-86.92	-87.12
8	.....	.....	-86.33	-86.97	-86.51	86.95	-87.07	-87.00	-86.57	-87.00	-87.12
9	.....	.....	-86.62	-87.02	-86.77	-87.04	87.04	87.02	-86.29	-86.86	-87.12
10	-80.65	.....	-86.46	-86.99	-86.68	-86.88	-86.73	-86.60	-86.35	-86.88	-87.18
11	-81.30	.....	-84.50	-86.88	-86.68	-86.77	86.90	-86.08	-86.44	-86.93	-87.11
12	-81.80	.....	-83.20	-86.89	-86.82	-86.89	86.84	-86.68	-86.47	-86.84	87.09
13	82.25	.....	-82.80	-86.80	-86.85	-86.87	-86.93	-86.76	-86.06	-86.83	-87.12
14	-82.72	.....	81.20	-87.01	-86.87	-86.83	86.94	-86.61	-86.77	-86.98	-87.12
15	.....	-83.70	80.38	-87.01	-86.80	-86.72	-86.97	-84.31	-86.57	.....	-87.12
16	.....	-84.14	-80.90	-87.08	-86.84	-86.85	-87.08	-84.06	-86.69	-86.95	-87.12
17	.....	-84.58	-81.41	-87.25	-86.96	-86.87	-87.16	-84.86	86.74	-86.93	-87.18
18	.....	-84.90	-82.15	-87.14	86.93	86.01	-87.25	-84.84	-86.64	-87.09	-87.11
19	.....	-84.92	-83.20	-87.10	-86.81	-86.35	-87.13	-85.14	-86.78	-87.05	-87.09
20	.....	-84.16	-83.72	-87.06	86.91	-86.65	-86.90	-85.38	-86.69	-86.91	-87.15
21	.....	-82.85	84.50	-87.05	-86.92	-86.71	-87.03	85.66	-86.71	-87.00	.....
22	.....	-82.75	85.00	-86.83	-86.92	86.64	-87.16	85.95	86.66	-86.03	.....
23	.....	-83.21	-85.45	-86.88	-86.94	-86.71	-87.13	-86.11	-86.75	-86.08	.....
24	.....	-84.05	85.90	86.77	-86.90	-86.87	-86.89	-86.40	-86.81	-85.97	.....
25	.....	-84.38	85.70	-86.84	87.06	-86.85	-87.01	-86.66	86.85	86.83	.....
26	.....	-84.98	-86.10	-86.93	-86.93	-86.90	87.03	86.60	-86.75	-86.56	.....
27	.....	-85.20	-86.17	-86.88	-87.00	-86.81	-86.80	-86.67	86.79	-86.90	-87.10
28	.....	-85.50	-86.27	-86.81	-86.98	-86.80	-86.24	86.70	86.80	86.75	.....
29	.....	-85.75	-86.70	86.74	-86.98	-86.79	86.58	86.75	86.86	-86.80	.....
30	.....	-85.89	-86.82	86.71	-87.06	-86.80	-86.82	-86.92	86.87	-86.55	.....
31	.....	-85.98	.....	-86.79	.....	86.80	-86.84	.....	-86.79	.....	.....

DESPLAINES RIVER ABOVE THE MOUTH OF JACKSON CREEK NEAR CHANNAHON, ILL.

This station was established October 23, 1902, by E. H. Heilbron. It is located just above the mouth of Jackson Creek, 2½ miles southwest of Millsdale, Ill. The gage is a vertical staff graduated to feet and tenths, and is read daily by Ruth Alexander. The measurements are taken from a cable and boat. The initial point for sounding is a red hub driven in the ground on the left bank near the end of the cable. The channel is straight for about 3,000 feet both above and below the station and has a width of 360 feet and a maximum depth of 16 feet at ordinary stages. Its flow is moderately rapid. Both banks of the stream are low and liable to overflow, but a few feet from the top of the banks on either side are high ridges, which never overflow. Measurements can be made at all stages. The bed of the stream is gravel.

The bench mark is the top of a red oak hub (the initial point for sounding) driven in the bluff between Jackson Creek and the south-

bank of the Desplaines River. It is about 300 feet west of the west line of sec. 15, T. 37 N., R. 9 E., third principal meridian, and is on the farm owned by George Alexander. Elevation, 64.262 feet below the Chicago datum. The gage is set with its zero at the same elevation as the zero of the Chicago datum, thus giving directly the elevation of the river surface below this datum. This station was located to give the discharge of the upper Desplaines River.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Desplaines River above mouth of Jackson Creek near Channahon, Ill., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 14	E. H. Heilbron	−80.45	8,031
April 18	do	−82.90	4,584
April 25	do	−82.32	6,114
May 8	do	−83.15	5,003
July 11	do	−82.90	5,447
August 30	do	−82.90	5,086
September 26	do	−82.80	5,892
October 28	F. W. Hanna	−82.78	5,666
November 25	do	−83.05	5,307
December 16	E. H. Heilbron	−82.90	[a] 4,380

[a] Partly frozen.

Mean daily gage height, in feet, of Desplaines River above mouth of Jackson Creek near Channahon, Ill., for 1903.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	−82.32	.....	−82.54	−83.25	−82.83	−83.11	−82.89	−82.91	−82.99	−82.80	−82.52
2	−82.42	.....	−82.55	−83.12	−82.90	−82.90	−82.95	−82.94	−82.93	−82.65	−82.36
3	−82.35	.....	−82.58	−83.10	−82.98	−82.88	−82.91	−82.94	−83.03	−83.05	−82.42
4	−82.30	.....	−82.80	−83.14	−82.93	−83.10	−82.71	−82.97	−82.82	−83.03	−82.36
5	−82.25	.....	−82.82	−83.11	−82.80	−83.00	−82.75	−82.90	−82.70	−83.00	−82.45
6	−82.30	.....	−82.65	−83.15	−82.80	−83.10	−83.18	−83.15	−82.91	−83.05	−82.50
7	−82.20	.....	−82.74	−83.24	−82.93	−83.00	−83.15	−83.10	−82.87	−83.10	−82.38
8	−82.20	.....	−82.91	−83.19	−82.83	−83.00	−83.23	−83.16	−82.70	−83.19	−82.39
9	−78.17	.....	−83.05	−83.17	−82.85	−83.00	−83.18	−83.15	−82.58	−83.16	−82.51
10	−78.63	.....	−82.74	−83.07	−82.95	−83.00	−82.90	−82.46	−82.55	−83.00	−82.54
11	−79.05	.....	−81.05	−83.00	−82.83	−82.90	−82.91	−82.25	−82.57	−83.05	−83.28
12	−79.60	.....	−80.94	−83.00	−82.90	−83.00	−83.03	−82.90	−82.69	−83.13	−83.31
13	−80.00	.....	−80.72	−83.00	−82.95	−83.00	−82.98	−82.93	−82.78	−83.00	−83.62
14	−80.35	.....	−79.25	−83.13	−82.88	−82.90	−82.95	−82.68	−82.78	−83.15	−83.28
15	.....	−81.12	−79.00	−83.20	−82.85	−82.90	−83.10	−81.25	−82.79	−84.50	−81.88
16	.....	−81.31	−79.30	−83.24	−82.92	−82.90	−83.23	−80.75	−82.84	−83.05	−82.05
17	.....	−81.69	−79.96	−83.31	−82.94	−82.90	−83.35	−81.45	−82.95	−83.15	(a)

[a] Missing.

Mean daily gage height, in feet, of Desplaines River, etc.—Continued.

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	.....	-81.78	-80.35	-83.22	-82.92	-82.20	-83.20	-81.34	-82.87	-83.20	-82.17
19	.....	-81.72	-80.95	-83.24	-82.94	-82.60	-83.20	-81.40	-82.98	-83.15	-82.79
20	.....	-80.96	-81.26	-83.14	-82.94	-82.80	-83.20	-81.68	-82.86	-83.12	-81.34
21	.....	-79.90	-81.72	-83.20	-83.05	-82.60	-83.13	81.65	-82.80	-82.13	-81.70
22	.....	-79.50	-81.97	-83.05	-82.90	-82.10	83.28	-82.30	-82.84	-82.13	-81.35
23	.....	-80.01	-82.10	-83.09	-83.03	-82.90	-83.02	-82.35	-82.82	-82.10	-81.72
24	.....	-80.65	-82.20	-83.10	-82.98	-82.90	83.00	-82.50	-82.99	-82.11	-81.88
25	.....	-80.85	-82.25	-83.05	-83.05	-83.00	-83.04	-82.72	-82.73	-82.50	-81.86
26	.....	-81.30	-82.61	-83.13	-83.00	-82.98	83.11	-82.76	-82.85	-82.70	-81.40
27	.....	-81.65	-82.65	-83.07	-83.07	-82.92	-82.93	-82.80	-82.93	-82.82	-81.40
28	.....	-81.92	-82.75	-83.02	-83.15	-82.92	-82.60	-82.85	-82.82	-82.68	-81.45
29	.....	-82.06	-83.20	-83.02	-83.07	-82.87	-82.65	-82.80	-82.93	-83.32	-81.30
30	.....	-82.18	-83.25	-82.82	-83.10	-82.87	-83.00	-82.97	-82.88	-82.38	-81.00
31	.....	-82.30	.....	-82.89	.....	-82.90	-83.00	.....	-82.83	.....	-80.56

WABASH RIVER DRAINAGE BASIN.

The drainage basin of the Wabash embraces an area of about 33,000 square miles, distributed as follows: In Ohio, 400 square miles; in Indiana, 24,350 square miles; in Illinois, 8,250 square miles. It drains, therefore, slightly more than two-thirds of Indiana, the area of the State being 35,910 square miles. Of the portion of Indiana, about one-half is embraced in the drainage areas of the East and West White rivers. By including these drainage areas with the Wabash, the entire basin has a nearly symmetrical, broadly ovate form. Not including the White River system, the Wabash Basin is an unsymmetrical, elongated tract, curving around White River.

The length of the valley occupied by the Wabash is about 450 miles, but the length of the stream is fully 500 miles, for the river in its lower course makes several oxbow curves within the valley. The source of the river is about 1,000 feet above tide, while its mouth at low water is but 311 feet. The average fall, if we estimate the stream to have a length of 500 miles, is therefore about 16.5 inches per mile. The rate of descent is far from uniform, being much more rapid in the upper portion than in the lower. There are also many rapids, separated by pools or sluggish portions of the stream. The elevation of the stream is accurately determined at many points, but in the absence of a careful measurement of the length of the stream the rate of fall is only approximately known. The section above the point where the river enters the old lake outlet, estimated to have a length of 100 miles, has a fall of about 300 feet, or 3 feet per mile. Railway levels and canal surveys at the point where the river joins the old lake outlet show its elevation to be nearly 700 feet above sea level, the altitudes reported varying between 696 and 699 feet.

The following table gives the elevation and fall at various points in this basin:

Table of altitudes and distances along Wabash River.

Location.	Estimated distance.	Altitude.	Fall per mile.
	Miles.	*Feet.*	*Feet.*
Source	0.0	1,000.0	0.00
Huntington	100.0	699.0	36.00
Mouth of Salamonie River	15.0	667.0	25.56
Mouth of Mississinewa River	20.0	633.0	20.40
Logansport	20.0	583.0	30.00
Lafayette	50.0	506.0	18.48
Attica	25.0	487.0	9.12
Covington	20.0	470.0	10.20
Terre Haute	55.0	447.7	4.80
State line	14.6	440.6	5.80
Hutsonville, Ill	29.0	424.6	6.60
Vincennes	46.4	398.8	6.60
Mouth on White River	32.5	376.5	8.30
Grayville, Ill	28.0	365.0	5.00
Mouth of Little Wabash	46.0	323.0	11.00
Mouth of Wabash River	16.0	311.0	9.00

During 1903 the United States Geological Survey maintained stations in this basin at Logansport, Delphi, Shoals, Cataract, Terra Haute, and Lafayette, Ind. The following are the drainage areas of the several streams at these points.

Drainage areas in Wabash River basin.

	Sq. miles.
Wabash River at Logansport	3,163
Upper Eel River at Logansport	887
Tippecanoe River at Delphi	1,890
Lower Eel River at Cataract	255
White River (East Branch) at Shoals	4,900
White River (West Branch) at Indianapolis	1,520

WHITE RIVER (EAST BRANCH) AT SHOALS, IND.

This station was established June 25, 1903, by A. C. Lootz. It is located at the highway bridge, in the village of Shoals, Ind., 400 feet above the Baltimore and Ohio Southwestern Railroad bridge. There are rapids just below this station and also about 5½ miles below. The gage is read once each day by O. H. Greist. The standard chain gage is fastened to the railing and metal posts of the downstream side of the first span on the left end of the highway bridge. The length of the chain from the end of the weight to the marker is 46.41 feet. This gage was established to take the place of the original vertical gage, which was fastened to one of the piers. Discharge measurements are made from the 3-span highway bridge to which the gage is attached. The initial point for soundings is the face of the left abut-

ment. The channel is straight above and below the station and the current is swift. The right bank is a high rocky road embankment and never overflows; the left bank is a steep rocky bluff and does not overflow. The bed of the stream is rocky, and the channel is divided into three parts by the bridge piers. Bench mark No. 1 is the stone cap on the downstream end of the first pier from the left bank. Its elevation is 100 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of White River (East Branch) at Shoals, Ind., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 22	A. C. Lootz		[a]2,000
August 4	L. R. Stockman	65.07	3,392
September 24	do	63.40	511

[a] Float measurement.

Mean daily gage height, in feet, of White River (East Branch) at Shoals, Ind., for 1903.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		64.50	63.60	63.50	63.40	63.50	63.70
2		64.40	64.70	63.50	63.40	63.50	63.70
3		64.30	64.80	63.50	63.40	63.50	63.70
4		64.10	65.30	63.50	63.50	63.50	63.60
5		64.00	66.10	63.50	63.50	63.50	63.60
6		64.20	66.90	63.50	63.50	63.50	63.50
7		64.20	66.80	63.50	63.60	63.50	63.50
8		64.10	66.00	63.50	63.70	63.50	63.50
9		64.10	65.50	63.50	63.80	63.50	63.60
10		64.10	65.10	63.50	63.90	63.50	63.60
11		64.00	64.90	63.50	63.90	63.50	63.50
12		64.00	64.60	63.50	63.90	63.50	63.50
13		63.90	64.40	63.50	64.00	63.50	63.50
14		63.90	64.10	63.50	64.00	63.50	63.50
15		63.80	64.10	63.50	63.90	63.50	63.50
16		63.80	64.00	63.40	63.90	63.50	63.50
17		63.80	64.00	63.40	63.80	63.50	63.50
18		63.90	64.00	63.40	63.70	63.70	63.50
19		63.80	63.90	63.40	63.70	63.70	63.50
20		63.70	63.90	63.40	63.60	63.70	63.60
21		63.70	63.90	63.40	63.60	63.80	64.10
22		63.50	63.80	63.40	63.50	63.90	64.20
23		63.50	63.80	63.40	63.50	64.00	64.20
24		63.50	63.70	63.40	63.50	63.90	64.50
25		63.50	63.70	63.40	63.50	63.80	64.60
26		63.50	63.70	63.40	63.50	63.70	64.90
27	64.30	63.50	63.60	63.40	63.50	63.70	65.20
28	64.30	63.60	63.60	63.40	63.50	63.60	65.00
29	64.40	63.60	63.60	63.40	63.50	63.60	65.00
30	64.50	63.60	63.50	63.40	63.50	63.70	64.80
31		63.60	63.50		63.50		64.60

Rating table for White River (East Branch) at Shoals, Ind., from June 22 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
63.4	510	64.7	2,600	67.0	6,970	69.6	11,910
63.5	640	64.8	2,790	67.2	7,350	69.8	12,290
63.6	770	64.9	2,980	67.4	7,730	70.0	12,670
63.7	910	65.0	3,170	67.6	8,110	70.5	13,620
63.8	1,050	65.2	3,550	67.8	8,490	71.0	14,570
63.9	1,200	65.4	3,930	68.0	8,870	71.5	15,520
64.0	1,350	65.6	4,310	68.2	9,250	72.0	16,470
64.1	1,510	65.8	4,690	68.4	9,630	72.5	17,420
64.2	1,680	66.0	5,070	68.6	10,010	73.0	18,370
64.3	1,860	66.2	5,450	68.8	10,390	73.5	19,320
64.4	2,045	66.4	5,730	69.0	10,770	74.0	20,270
64.5	2,230	66.6	6,210	69.2	11,150		
64.6	2,415	66.8	6,590	69.4	11,530		

Table made from measurements of August 4 and September 24, 1903, and January 24, 1904. Table should be accurate to limiting height in 1903.

Estimated monthly discharge of White River (East Branch) at Shoals, Ind., for 1903.

[Drainage area, 4,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
June 27–30	2,230	1,860	1,999	0.41	0.06
July	2,230	640	1,165	.24	.28
August	6,780	640	2,181	.45	.52
September	640	510	575	.12	.13
October	1,350	510	829	.17	.20
November	1,350	640	791	.16	.18
December	3,550	640	1,350	.28	.32

LOWER EEL RIVER AT CATARACT, IND.

This station was established by E. Johnson, jr., assisted by L. R. Stockman. It is located 6 miles from Cloverdale, Ind., and one-half mile southwest of Cataract, Ind. It is 300 feet above a dam below which there is a fall of 35 feet. The gage is a 3 by 6 inch oak timber, securely fastened to the west abutment on the downstream face. It is marked by brass-headed nails and reads from zero to 10 feet.

The gage is read once each day by Joe Steiner. Discharge measurements are made from the upstream side of the single-span, covered highway bridge, which has a length between abutments of 128 feet. The initial point for soundings is the face of the left or west abutment at the top of the coping on the upstream side. Distances are marked by wire nails and painted figures on the guard rail on the upstream side of the bridge. The channel is straight for about 500 feet above and 300 feet below the bridge. The current varies from swift to rather sluggish. Both banks are high and rocky and will not overflow. The bed of the stream is a smooth rock ledge, nearly level between the bridge abutments.

Bench mark No. 1 is a wire nail in the root of a small elm tree in a stone wall on the north side of the road approaching the bridge on the west side of the river about 50 feet from the bridge. Its elevation above the zero of the gage is 12.60 feet. Bench mark No. 2 is a wire nail in the root of a large oak tree in the pasture on the west side of the river 300 feet from the bridge and 20 feet from the fence which bounds the south side of the road approaching the bridge. The elevation of this bench mark is 27.20 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of lower Eel River at Cataract, Ind., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 6	E. Johnson, jr	2.60	1,479
August 12	do	1.30	127
September 25	L. R. Stockman	1.04	14

Mean daily gage height, in feet, of lower Eel River at Cataract, Ind., for 1903.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.20	1.10	1.20	1.30	17	1.15	1.35	1.20	1.30	1.30
2	.....	1.15	1.10	1.20	1.25	18	1.20	1.30	1.20	1.30	1.30
3	.....	1.15	1.10	1.20	1.30	19	1.10	1.30	1.15	1.30	1.40
4	.....	1.20	1.30	1.20	1.30	20	1.10	1.15	1.20	1.30	1.60
5	.....	1.15	1.20	1.20	1.30	21	1.10	1.15	1.30	1.30	1.60
6	2.60	1.00	1.30	1.20	1.30	22	1.10	1.25	1.20	1.20	1.60
7	2.00	1.00	2.50	1.20	1.35	23	1.10	1.20	1.20	1.25	1.60
8	1.55	1.00	2.70	1.20	1.35	24	1.10	1.20	1.20	1.20	1.60
9	1.50	1.00	2.20	1.20	1.35	25	1.10	1.15	1.20	1.30	1.60
10	1.40	1.00	2.10	1.20	1.35	26	1.10	1.15	1.20	1.30	1.60
11	1.35	1.00	1.20	1.20	1.40	27	1.10	1.10	1.20	1.25	1.40
12	1.30	1.00	1.15	1.30	1.40	28	1.05	1.15	1.20	1.20	1.40
13	1.20	1.10	1.15	1.40	1.30	29	1.20	1.10	1.15	1.30	1.40
14	1.20	1.10	1.15	1.30	1.30	30	1.15	1.05	1.20	1.30	1.40
15	1.20	1.15	1.60	1.30	1.30	31	1.20	.....	1.20	.....	1.40
16	1.15	1.30	1.30	1.30	1.30						

WABASH RIVER AT TERRE HAUTE, IND.

The gage is located at the pump house of the Terre Haute Water-Works Company, and is read once each day by D. M. Rambarger. It is a chain gage connecting through a horizontal pipe with a float in a well and operating a pointer on a vertical gage in the pump house. Gage readings were begun August 3, 1902. The records consist of gage heights only, as no station suitable for discharge measurements has been selected in this vicinity.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Mean daily gage height, in feet, of Wabash River at Terre Haute, Ind., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.90	14.65	15.15	3.10	5.20	5.50	1.90	1.40	1.60	−0.10	−0.50	−0.40
2	5.60	15.25	15.70	3.55	4.80	5.00	1.60	1.00	1.80	− .10	− .60	− .40
3	6.20	15.65	16.05	3.45	4.75	5.50	1.60	1.00	1.80	− .05	− .60	− .40
4	7.90	15.80	17.30	6.70	4.11	5.80	5.60	2.10	1.50	.00	− .70	− .50
5	8.15	15.95	18.30	9.20	3.11	5.80	9.65	5.20	1.00	.15	− .70	− .50
6	8.70	15.90	18.80	10.90	3.90	5.80	8.95	3.55	1.00	.20	− .60	− .50
7	8.50	15.10	17.65	12.70	3.40	8.00	7.05	2.55	1.00	.30	− .60	− .50
8	8.95	15.11	17.30	12.75	3.10	8.55	6.00	2.00	.80	.65	− .70	− .50
9	8.45	15.65	16.65	11.80	2.10	9.50	4.90	1.80	.80	.80	− .70	− .60
10	6.45	14.60	16.70	9.95	2.10	8.80	4.00	1.70	.50	1.00	− .70	− .60
11	3.40	13.50	16.80	9.40	2.85	7.45	3.70	1.50	.30	1.60	− .70	− .60
12	3.00	14.06	16.70	.....	2.70	6.30	3.80	1.40	.10	1.80	− .60	− .60
13	2.45	15.50	15.65	.....	2.60	5.50	3.85	1.30	.00	1.75	− .60	− .60
14	2.60	15.15	15.35	.....	2.55	4.00	3.30	1.10	.00	1.60	− .60	− .60
15	2.50	17.05	14.85	.....	2.40	3.60	2.00	.10	.00	1.00	− .50	− .60
16	3.40	17.90	13.50	.....	2.30	3.00	2.00	.90	.50	.80	− .50	− .50
17	3.05	17.40	13.45	.....	2.30	2.60	1.10	.80	.15	.70	− .20	1.00
18	4.50	16.20	12.25	.....	2.10	2.40	1.10	.60	.00	.40	.10	1.40
19	4.70	14.25	10.15	19.10	1.11	2.00	1.80	.50	.00	.30	.20	1.90
20	4.60	10.30	9.50	17.65	1.10	2.00	1.70	.45	.30	.20	.20	1.90
21	4.00	7.95	8.70	16.15	1.80	2.20	1.80	.40	.40	.10	.20	2.80
22	4.10	7.15	8.10	13.55	5.60	2.20	1.10	.20	.50	.00	− .10	3.00
23	3.60	6.85	7.45	10.75	7.80	2.40	1.10	.20	.50	.00	.00	3.75
24	3.55	6.10	6.65	8.80	4.00	2.30	1.85	.00	.40	− .10	.00	3.85
25	3.30	6.85	5.55	7.35	4.10	2.30	1.80	− .10	.30	− .10	− .10	3.75
26	3.10	6.70	5.30	7.30	4.40	2.30	1.70	− .10	.30	− .20	− .10	4.15
27	3.40	7.80	5.05	7.05	4.75	2.30	1.50	.25	.20	− .20	− .20	4.05
28	5.90	13.15	4.55	6.50	5.50	2.20	1.40	.65	.10	− .30	− .30	3.10
29	11.50	.....	4.10	6.30	5.75	2.00	1.40	2.10	.00	− .30	− .30	3.00
30	14.05	.....	4.50	5.50	5.90	1.10	1.40	1.80	.00	− .40	− .40	3.00
31	14.30	.....	4.20	.....	5.95	.....	1.40	1.60	.....	− .50	.....	3.60

WABASH RIVER AT LAFAYETTE, IND.

This station was established May 2, 1901, by George E. Waesche, and is carried on in connection with the Civil Engineering College of Purdue University. It is about one-half mile above Brown Street Bridge, Lafayette, Ind., and about one-fourth mile below the West

Lafayette pumping station. The gage is on the left bank and is in two parts. The lower portion is a 2 by 4 inch white-pine plank, graduated to feet and hundredths, extending down into an 18-inch sewer pipe, into which the water from the river is admitted. The upper portion of the gage is graduated to feet and tenths and is nailed to a large sycamore tree.

The measurements are made by means of a boat held in place by a wire cable. The cable is adjustable, so that it can be placed at any height above the surface of the water. The initial point for sounding is a gas-pipe plug set firmly in the west bank 25 feet east of the pole which supports the west end of the cable. The channel is straight both above and below the station, has a width of 550 feet and a maximum depth of 3 feet at ordinary stages, and is unobstructed except for a small sand bar at the mouth of a small stream which enters the river 1,500 feet above the station. The current is uniform. The banks are low and overflow at high water. The bed of the stream is a gravelly mixture, comparatively smooth, and slightly shifting. The bench mark is the head of a brass rod embedded in a block of concrete placed about 150 feet upstream from the gage. Its elevation is 515.46 feet above sea level and 14.31 feet above the zero of the gage. The gage is read by the students of Purdue University.

Discharge measurements of Wabash River at Lafayette, Ind.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 22	G. E. Waesche	3.50	5,245
April 5	do	4.15	6,313
June 4	do	7.35	11,693
Do	do	7.35	12,157
July 26	do	3.12	4,089
Do	do	3.12	3,953
1903.			
April 24	G. E. Waesche	1.40	1,822
May 3	do	2.00	2,496
May 13	do	2.18	2,198
May 15	do	2.30	1,637
May 16	do	2.30	2,232
June 2	do	7.35	12,157
June 18	do	2.02	1,984
June 19	do	1.88	1,686

Mean daily gage height, in feet, of Wabash River at Lafayette, Ind., for 1902 and 1903.

Day.	1902.		1903.				
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1		3.25	4.28	13.64	17.77	3.15	3.60
2		4.50	4.60	11.52	18.12	3.11	3.65
3		6.25	5.35	10.30	16.80	3.15	
4		8.00	6.91	14.17	14.78	10.00	
5		7.70	8.67	16.40	13.05		
6		6.04	8.35	14.80	13.16		
7		5.20	7.39	12.30	13.00		
8		4.66	6.48	10.20	12.05		
9		3.92	4.87	8.60	12.52		
10	2.53	3.45	4.03	7.27	13.14		
11	2.75	3.56	3.53	7.94	13.62		
12	3.19	3.74	3.44	13.82	12.94		
13	3.33	3.85	3.28	16.05	11.53		
14	3.15	3.65	5.10	15.74	9.88		
15	3.08	3.75	5.42	13.98	8.52		
16	3.04	4.90	5.52	10.42	7.40		
17	3.18	7.70	5.38	8.22	6.72		
18	4.20	9.12	4.75	6.15	6.86		
19	5.68	8.35	4.48	4.93	6.78		
20	5.53	7.95	4.30	4.48	6.26		
21	5.80	10.70	4.27	4.70	5.74		
22	4.30	14.38	3.84	5.00	5.00		
23	3.82	15.46	3.79	4.83	5.00		
24	3.37	14.40	3.50	4.60	4.78		
25	3.07	11.75	3.19	4.44	4.44		
26	2.95	9.14	3.36	4.52	4.16	4.80	
27	2.84	7.90	4.50	5.10	3.72	4.80	
28	2.81	6.65	5.75	12.43	3.28	4.41	
29	2.90	6.08	11.40		3.58	3.80	
30	3.12	5.37	15.68		3.74	3.60	
31		4.47	15.00		3.35		

TIPPECANOE RIVER AT SPRINGBORO, IND.

This station was established March 14, 1903, by George E. Waesche. The station is located at the highway bridge at Springboro, Ind. The nearest railroad station is Delphi, 5 miles east of Springboro. The standard chain gage is located on the second span from the east bank, one panel length beyond the center of the span. The length of the chain from the end of the weight to the marker is 25.66 feet. The gage is read once each day by Lois Imler. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is the face of the east abutment. The channel is straight for about 1,600 feet above and about 2,000 feet below the station. Its width at ordinary stages is 350 feet, broken by two piers, and at high water is 510 feet, broken by three piers. Both banks are high and can not overflow to any considerable extent. The bed of the stream is rocky and rough; the current is swift. The bench mark is the head of an anchor bolt in the east

abutment; it is the outside anchor of the downstream truss. Its elevation above the zero of the gage is 22.25 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Tippecanoe River at Springboro, Ind., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 16	G. E. Waesche	4.73	3,448
May 18	do	3.00	747
June 22	do	2.87	662
July 17	E. C. Murphy	3.03	892
August 14	E. Johnson	2.75	584
September 30	L. R. Stockman	3.05	704
November 11	do	3.03	653
December 29	E. Johnson, jr	4.00	[a] 1,083

[a] Partly frozen.

Mean daily gage height, in feet, of Tippecanoe River at Springboro, Ind., for 1903.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.50	3.82	3.42	2.78	2.99	2.94	3.10	3.08	3.10
2		3.50	3.80	3.42	4.20	3.00	3.53	3.20	3.06	3.09
3		3.72	3.73	3.28	7.03	3.03	3.40	3.40	3.09	3.08
4		4.94	3.65	3.16	7.07	3.11	3.32	3.50	3.10	3.10
5		5.54	3.57	3.50	7.18	2.99	3.28	3.47	3.09	3.12
6		5.37	3.52	4.15	6.40	3.16	3.02	3.54	3.08	3.18
7		5.00	3.49	4.59	5.54	3.07	2.90	3.70	3.06	3.22
8		4.64	3.43	4.63	5.05		2.88	3.90	3.05	3.28
9		4.18	3.36	4.12	4.50	2.96	2.70	4.17	3.04	3.26
10		4.21	3.32	3.77	4.10	2.98	2.81	4.07	3.02	3.24
11		5.25	3.24	3.67	3.88	2.99	2.87	4.00	3.03	3.21
12		6.69	3.20	3.26	3.76	3.00	2.94	3.93	3.10	3.20
13		8.55	3.18	3.28	3.56	2.80	2.80	3.87	3.09	3.29
14	5.18	9.65	3.16	3.16	3.40	2.77	2.90	3.81	3.05	3.95
15	4.90	9.30	3.13	3.09	3.27	2.73	3.20	3.74	(a)	4.15
16	4.75	8.53	3.10	3.04	3.15	2.84	3.60	3.67	(a)	(b)
17	4.58	7.86	3.09	3.02	3.07	2.85	3.70	3.63	(a)	(b)
18	4.58	7.10	3.04	3.00	3.10	2.82	3.79	3.58	(a)	(b)
19	4.52	6.02	2.99	2.93	3.66	2.81	3.83	3.40	(a)	(b)
20	4.35	4.89	2.95	2.96	4.00	2.84	3.60	3.39	(a)	4.20
21	4.54	5.30	2.93	2.98	3.87	2.86	3.50	3.38	(a)	4.18
22	4.40	4.85	2.99	2.87	3.45	2.85	(c)	3.36	3.02	4.16
23	4.22	4.62	3.10	2.93	3.30	2.83	(c)	3.35	3.05	4.14
24	3.97	4.47	3.28	2.96	3.14	2.81	(c)	3.34	3.08	4.15
25	3.87	4.33	3.72	2.92	3.10	3.01	(c)	3.31	3.07	4.13
26	3.88	4.47	4.05	2.87	3.05	2.94	(c)	3.25	3.05	4.17
27	3.82	4.38	4.08	2.93	2.97	2.96	(c)	3.24	3.04	4.16
28	3.78	4.14	3.80	2.86	2.93	2.97	(c)	3.20	3.07	4.15
29	3.70	4.05	3.70	2.83	2.91	2.98	(c)	3.19	3.09	4.14
30	3.60	3.90	3.54	2.82	2.94	3.01	3.05	3.14	3.11	4.13
31	3.50		3.38		2.96	2.97		3.09		4.13

[a] Gage reader absent. [b] Frozen. [c] Gage stolen.

Rating table for Tippecanoe River at Springboro, Ind., from March 14 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.7	551	4.0	1,987	5.3	4,230	7.2	7,650
2.8	611	4.1	2,151	5.4	4,410	7.4	8,010
2.9	680	4.2	2,320	5.5	4,590	7.6	8,370
3.0	758	4.3	2,490	5.6	4,770	7.8	8,730
3.1	845	4.4	2,660	5.7	4,950	8.0	9,090
3.2	940	4.5	2,830	5.8	5,130	8.5	9,990
3.3	1,043	4.6	3,000	5.9	5,310	9.0	10,890
3.4	1,154	4.7	3,170	6.0	5,490	9.5	11,790
3.5	1,273	4.8	3,345	6.2	5,850	10.0	12,690
3.6	1,400	4.9	3,520	6.4	6,210	10.5	13,590
3.7	1,535	5.0	3,695	6.6	6,570	11.0	14,490
3.8	1,678	5.1	3,870	6.8	6,930		
3.9	1,829	5.2	4,050	7.0	7,290		

Estimated monthly discharge of Tippecanoe River at Springboro, Ind., for 1903.

[Drainage area, 1,890 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
March 14–31	4,050	1,273	2,399	1.27	0.85
April	12,060	1,273	4,582	2.43	2.71
May	2,151	719	1,197	.63	.73
June	3,085	611	1,112	.59	.66
July	7,650	611	2,194	1.16	1.34
August [a]	892	581	710	.38	.44
September [b]	1,753	551	962	.51	.57
October	2,235	845	1,326	.70	.81
November [c]	845	758	812	.43	.48
December [d]	2,320	845	1,681	.89	1.03

[a] August 8 estimated.
[b] Gage stolen. Discharge estimated September 22–30.
[c] November 15–21 estimated.
[d] December 16–19 frozen. Discharge estimated.

WABASH RIVER AT LOGANSPORT, IND.

This station was established April 27, 1903, by George E. Waesche, It is located at the Cicott street bridge, about 1 mile from the center of the city of Logansport, 1¾ miles from the Wabash Railroad station, 1½ miles from the Pennsylvania station, four blocks from the street car line, and 1,000 feet below the mouth of Eel River. The standard chain gage is placed on the second span of the bridge, at the third panel from the second pier, and is supported by the bridge pins, and is between the lower chord bars. It is reached through a trap door in the floor planks of the bridge. The distance from the end of the weight to the marker is 20.78 feet. The gage is read once each day by C. B. Woodruff. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is the back wall of the bridge seat for the north abutment. The channel is nearly straight for 1,000 feet above and for 1,500 feet below the station. The distance between abutments is 550 feet, and the channel is broken by three bridge piers. The right bank is high, and is not subject to overflow at the bridge. The left bank is submerged only at extreme high water. The bed of the stream is covered with small bowlders and is rough. The stream is shallow and the current is never sluggish. Bench mark No. 1 is the top of the north abutment, under the fourth board of the downstream sidewalk. Its elevation above gage datum is 18.814 feet. From Pennsylvania Railroad levels its elevation above sea level has been found to be 591 feet. Bench mark No. 2 is the top of the third course of masonry from the top of the north abutment. Its elevation above the zero of the gage is 15.31 feet.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Wabash River at Logansport, Ind., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
April 27	Geo. E. Waesche	2.50	2,367
June 8	do	4.55	7,180
June 16	do	(?)	1,444
July 8	do	2.30	1,358
July 16	E. C. Murphy	1.54	719
August 15	E. Johnson, jr	1.35	418
September 30	L. R. Stockman	1.30	349
November 10	do	1.38	452
December 28	E. Johnson, jr	2.75	1,285

Mean daily gage height, in feet, of Wabash River at Logansport, Ind., for 1903.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.15	2.30	1.55	1.70	1.70			1.30
2		2.10	2.25	10.15	1.60	1.70			1.30
3			2.70	7.25	1.50	1.70	(a)		1.40
4		2.00	2.50	4.80	1.60	1.70			1.50
5		2.00	3.25	3.65	1.60	1.70			1.60
6		1.95	4.15	3.00	1.55	1.92			1.70
7		1.90	5.50	2.55	1.55	1.72			1.50
8		1.90		2.30	1.50	1.72			1.45
9		1.90	4.30	2.15	1.45	1.70			1.40
10			3.65	2.00	1.40	1.40	(a)	1.40	1.40
11		1.80	3.10	1.90	1.40	1.40		1.40	1.85
12		1.80	2.65	1.95	1.35	1.35		1.40	1.85
13		1.80	2.40	1.90	1.35	1.35		1.40	2.40
14		1.75	2.25	1.25	1.35	1.40		1.40	2.90
15		1.75	2.10	1.70	1.35	1.40		1.40	2.90
16		1.75	1.95	1.60	1.45	1.40		1.50	2.90
17			1.85	1.60	1.40	1.40	(a)	1.50	2.70
18		1.70	1.80	1.75	1.40	1.40		1.80	2.40
19		1.65	1.80	1.85	1.30	1.40		1.60	2.40
20		1.65	1.75	1.85	1.35	(a)		1.40	2.40
21		1.60	1.70	1.80	1.35			1.50	2.70
22		1.65	1.80	1.70	1.30			1.50	2.90
23		1.70	2.05	1.80	1.30			1.40	2.90
24		2.15	2.20	1.75	1.30		(a)	1.40	2.70
25		2.80	2.00	1.70	1.30			1.40	2.70
26		2.70	1.85	1.70	1.30			1.40	2.70
27	2.50	3.00	1.75	1.70	1.35			1.40	2.80
28	2.40	3.60	1.70	1.60	1.90			1.40	2.75
29	2.30	3.30	1.60	1.60	2.10			1.40	2.65
30	2.20	2.85	1.60	1.65	1.90			1.30	2.60
31		2.60		1.70	1.70				2.53

a Observer absent.

Rating table for Wabash River at Logansport, Ind., from April 27 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.3	380	2.6	1,990	4.8	8,100	8.0	22,780
1.4	460	2.7	2,170	5.0	8,890	8.5	25,130
1.5	550	2.8	2,360	5.2	9,720	9.0	27,480
1.6	650	2.9	2,560	5.4	10,590	9.5	29,830
1.7	750	3.0	2,770	5.6	11,500	10.0	32,1 0
1.8	860	3.2	3,200	5.8	12,440	10.5	34,530
1.9	980	3.4	3,670	6.0	13,380	11.0	36,880
2.0	1,100	3.6	4,180	6.2	14,320	11.5	39,230
2.1	1,230	3.8	4,740	6.4	15,260	12.0	41,580
2.2	1,370	4.0	5,340	6.6	16,200	12.5	43,930
2.3	1,510	4.2	5,970	6.8	17,140	13.0	46,280
2.4	1,660	4.4	6,640	7.0	18,080		
2.5	1,820	4.6	7,350	7.5	20,430		

Estimated monthly discharge of Wabash River at Logansport, Ind., for 1903.

[Drainage area, 3,163 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
April 27–30	1,820	1,370	1,590	0.50	0.07
May [a]	4,180	650	1,337	.42	.48
June [b]	11,040	650	2,304	.73	.81
July	32,885	345	2,922	.92	1.06
August	1,230	380	549	.17	.20
September 1–19 [c]	980	420	605	.19	.13
October [c]					
November 10–30 [c]	860	380	501	.16	.12
December	2,560	380	1,541	.49	.56

[a] 3 days estimated. [b] 1 day estimated. [c] Observer left.

UPPER EEL RIVER AT LOGANSPORT, IND.

This station was established April 27, 1903, by George E. Waesche. It was located at Uhl's milldam, in the city of Logansport, just above the junction of the Eel and Wabash rivers. The dam is suitable for determining the discharge, considering it as a weir, but it is also necessary to compute the flow through the mill turbines by keeping a record of the head and gate openings under which the wheels are operated. The depth of water on the crest of the dam was recorded from April 27 to September 19, from November 10 to December 12, and from December 20 to 31, 1903. An accurate record of the amount of water passing through the turbines could not be obtained, and the station was discontinued for this reason. The amount of water passing over the crest of the dam was not computed, as the other records were lacking.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

MISCELLANEOUS MEASUREMENTS IN WABASH RIVER DRAINAGE BASIN.

Discharge measurements of White (West Branch) River at Indianapolis, Ind., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 13	George E. Waesche		1,444
August 14	E. Johnson, jr.	3.60	279
September 26	L. R. Stockman	3.20	171

MUSKINGUM RIVER DRAINAGE BASIN.

Muskingum River is formed by the junction of Walhonding and Tuscarawas rivers in the east-central part of Ohio, flows south, and enters Ohio River at Marietta, Ohio. In this drainage basin the United States Geological Survey has two stations—one on Jonathan Creek, at Powells, Ohio, and the other on Licking River, at Pleasant Valley, Ohio. These two streams enter the main river near Zanesville.

JONATHAN CREEK AT POWELLS, OHIO.

Jonathan Creek flows into Muskingum River a short distance below Zanesville, Ohio.

The gaging station at Powells was established November 15, 1902, by Benjamin H. Flynn, and was discontinued July 20, 1903. It was located on the railroad bridge, one-fourth of a mile north of the railroad station. The gage is a plain staff graduated to feet and tenths. The channel is straight both above and below the station. The river is confined to its channel by the railroad embankments. The bed of the stream is rocky. Low-water discharge measurements are made by wading; high-water measurements, from the bridge. The bench mark is a cut on the downstream side of the wing wall of the left abutment; elevation, 7 feet above the zero of the gage. The drainage area at this point is 189 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Jonathan Creek near Powells, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 12	E. Johnson, jr	2.45	899
June 25	R. W. Pratt	.90	34

Mean daily gage height, in feet, of Jonathan Creek near Powells, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr	June.	July
1	7.05	1.90	5.90	1.30	.....	0.80	17	1.20	2.60	2.90	2.10	.....	0.75
2	1.15	2.30	2.40	1.30	.....	.80	18	1.90	2.10	1.90	1.80	.....	.80
3	7.00	1.80	2.30	1.75	.....	.90	19	1.50	1.90	1.75	.....	.....	.75
4	3.00	1.10	2.00	1.70	.....	.80	20	1.40	1.70	1.60	.....	.....	.70
5	2.00	2.90	2.30	1.20	.....	.80	21	1.75	1.70	1.30	.....	1.20	.75
6	1.70	1.90	2.00	1.20	.....	.90	22	1.50	1.60	1.80	.....	.90	.90
7	1.40	1.80	1.90	1.20	.....	.80	23	1.35	1.40	1.70	.....	1.00	.90
8	1.20	1.90	6.10	1.50	.....	.80	24	1.20	1.70	1.60	.....	.90	.90
9	1.20	1.70	3.90	2.70	.....	.80	25	1.05	1.70	1.40	.....	.90	.90
10	1.30	1.40	2.60	1.80	.....	.75	26	1.00	1.60	1.30	.....	.90	.....
11	1.60	1.50	6.30	1.60	.....	.80	27	1.80	1.85	1.25	.....	.85	.....
12	1.80	2.10	2.60	2.70	.....	.80	28	4.20	12.60	1.20	.....	.90	.....
13	1.90	1.70	2.30	2.70	.....	.80	29	3.00	.....	1.10	.....	.90	.....
14	2.30	1.60	1.90	3.90	.....	.80	30	3.00	.....	1.05	.....	.90	.....
15	2.00	1.80	1.80	2.20	.....	.80	31	1.60	.....	1.00	.....	.....	.....
16	1.50	6.10	1.70	2.90	.....	.80							

LICKING RIVER AT PLEASANT VALLEY, OHIO.

Licking River flows into the Muskingum at Zanesville.

The gaging station at Pleasant Valley was established November 14, 1902, by Benjamin H. Flynn. It is located at the highway bridge, 300 feet north of the railroad station at Pleasant Valley, Ohio. The lower part of the gage is inclined and spiked to a post driven into the bank. The upper part is vertical and spiked to a tree. It is graduated to read direct to feet and tenths. The channel is straight for 200 feet above and 300 feet below the station. The banks are high and not liable to overflow, except in extreme floods. The bed of the stream is gravel and clay. The low-water measurements are made by wading and the high-water measurements from the highway bridge.

There are three bench marks. The first is a copper nail on the gage tree; elevation, 13 feet above the zero of the gage. The second is three copper nails on a walnut tree 200 feet west of the gage; elevation, 15, 16, and 17 feet above the zero of the gage. The third consists of four copper nails on a telephone pole north of the tree; elevation, 13, 14, 15, and 16 feet above the zero of the gage. The initial point for soundings is a cross on the top stone of the downstream side of the right abutment of the highway bridge.

The drainage area at Pleasant Valley is 696 square miles.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Licking River at Pleasant Valley, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 13	E. Johnson, jr	6.50	2,618
June 25	R. W. Pratt	1.75	147
October 3	do	1.25	76
November 30	do	1.27	72

Mean daily gage height, in feet, of Licking River at Pleasant Valley, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	6.40	14.50	3.20	2.60	2.10	2.00	1.40	1.30	1.20	1.20	1.30
2	2.50	5.20	8.60	3.00	2.60	2.10	2.00	1.40	1.30	1.20	1.20	1.30
3	2.60	6.60	5.90	3.00	2.70	2.00	1.90	1.40	1.30	1.20	1.20	1.20
4	12.10	12.10	5.10	3.70	2.60	2.00	1.70	1.40	1.30	1.20	1.20	1.20
5	8.20	12.00	5.00	3.90	2.60	1.90	1.60	1.40	1.30	1.20	1.20	1.20
6	6.20	5.80	5.40	3.50	2.50	1.90	1.70	1.40	1.30	1.20	1.20	1.20
7	5.50	4.70	5.50	3.30	2.40	2.00	1.70	1.40	1.30	1.20	1.20	1.20
8	5.00	4.80	13.35	3.10	2.30	2.10	1.60	1.40	1.20	1.40	1.20	1.20

Mean daily gage height, in feet, of Licking River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
9	4.70	4.70	14.10	5.50	2.20	2.10	1.60	1.40	1.20	1.60	1.20	1.30
10	4.50	4.20	9.00	4.70	2.20	2.00	1.80	1.40	1.20	1.50	1.20	1.30
11	6.40	3.80	13.10	3.90	2.20	2.00	2.20	1.40	1.20	1.40	1.20	1.30
12	5.50	6.00	10.10	4.80	2.10	2.00	2.10	1.40	1.30	1.30	1.20	1.30
13	5.40	5.00	6.60	7.00	2.10	2.10	1.90	1.40	1.30	1.30	1.30	1.30
14	5.20	4.10	5.60	10.00	2.00	2.00	1.70	1.30	1.30	1.30	1.40	1.30
15	5.00	4.00	5.00	8.20	2.00	2.00	1.70	1.30	1.20	1.20	1.40	1.30
16	4.60	9.00	4.60	7.90	2.00	1.90	1.60	1.30	1.20	1.20	1.80	1.30
17	4.30	7.20	5.10	6.80	2.00	1.80	1.60	1.30	1.20	1.20	1.90	1.30
18	4.50	5.70	5.40	5.10	2.00	1.80	1.60	1.30	1.20	1.20	1.90	1.30
19	3.70	4.50	4.70	4.40	2.00	1.80	1.60	1.30	1.20	1.20	1.80	1.30
20	3.20	4.00	4.20	4.10	1.90	1.90	1.50	1.30	1.20	1.20	1.80	4.90
21	3.80	3.80	5.10	3.70	1.90	2.00	1.50	1.30	1.20	1.20	1.70	4.70
22	3.90	3.30	4.70	3.80	1.90	2.00	1.50	1.30	1.20	1.20	1.60	4.20
23	3.60	3.00	4.20	3.60	2.10	2.00	1.50	1.30	1.20	1.20	1.60	3.80
24	2.80	3.30	3.90	3.20	2.20	1.90	1.50	1.30	1.20	1.20	1.50	3.60
25	2.70	3.40	3.70	3.10	2.20	1.80	1.40	1.30	1.20	1.20	1.50	3.50
26	2.60	3.50	3.50	3.20	2.90	1.70	1.40	1.30	1.20	1.20	1.50	3.40
27	3.00	3.90	3.30	3.00	3.30	1.70	1.40	1.30	1.20	1.20	1.50	3.30
28	7.20	14.00	3.20	2.90	3.30	1.70	1.40	1.30	1.20	1.20	1.40	3.20
29	10.60	.....	3.10	2.80	3.20	2.30	1.40	1.30	1.20	1.20	1.40	3.10
30	10.80	.....	3.00	2.70	2.40	2.20	1.40	1.30	1.20	1.20	1.30	3.00
31	7.00	.....	3.90	.....	2.30	.....	1.40	1.30	.....	1.20	.....	2.90

Rating table for Licking River at Pleasant Valley, Ohio, from November 14, 1902, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	72	2.5	375	3.8	935	5.1	1,660
1.3	77	2.6	412	3.9	985	5.2	1,725
1.4	86	2.7	450	4.0	1,035	5.3	1,790
1.5	99	2.8	490	4.1	1,085	5.4	1,855
1.6	116	2.9	530	4.2	1,140	5.5	1,920
1.7	136	3.0	570	4.3	1,195	5.6	1,985
1.8	159	3.1	610	4.4	1,250	5.7	2,050
1.9	184	3.2	655	4.5	1,305	5.8	2,120
2.0	211	3.3	700	4.6	1,360	5.9	2,190
2.1	240	3.4	745	4.7	1,420	6.0	2,260
2.2	271	3.5	790	4.8	1,480	6.1	2,330
2.3	304	3.6	835	4.9	1,540		
2.4	339	3.7	885	5.0	1,600		

Tangent at 6 feet. Differences above this point, 70 per tenth.

Estimated monthly discharge of Licking River at Pleasant Valley, Ohio.

[Drainage area, 696 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
1902.					
November 14–30	885	99	342	0.49	3.10
December	6,040	304	1,220	1.75	2.02
1903.					
January	6,530	375	1,839	2.64	3.04
February	7,860	570	2,127	3.06	3.18
March	8,210	570	2,496	3.58	4.13
April	5,060	450	1,347	1.94	2.16
May	700	184	330	.47	.54
June	304	136	202	.29	.32
July	271	86	131	.19	.22
August	86	77	81	.12	.14
September	77	72	74	.11	.12
October	116	72	76	.11	.13
November	184	72	99	.14	.16
December	1,540	72	384	.55	.63
The year	8,210	72	766	1.10	14.77

LITTLE MIAMI RIVER DRAINAGE BASIN.

Little Miami River rises in the southeastern part of Clark County, flows southwest through Greene and Warren counties, and enters the Ohio River just above Cincinnati. The greater part of the drainage area lies to the east, as there is only a narrow piece of country between this and the Miami River. The Little Miami is the best power river in the State. The United States Geological Survey maintained a station on the Little Miami at Morrow in 1903, where its drainage area is 951 square miles. This station was discontinued owing to the location, which proved unsuitable at low water.

LITTLE MIAMI RIVER NEAR MORROW, OHIO.

The station was established May 29, 1903, by R. Winthrop Pratt, and was discontinued July 27, 1903. It was located at Stubb's mills, 2 miles west of the railroad station at Morrow, at the highway bridge, 500 feet west of the mouth of Todds Fork. The gage consists of a

1 by 6 inch pine board 14 feet long on the downstream side of north abutment. The gage was read twice a day by T. J. Buchanan. Discharge measurements were made from the two-span covered bridge, which is about 225 feet in length between abutments. The initial point for soundings is a cut in the bridge rail on the downstream side, approximately over the face of the north abutment. Underneath it is painted "O U. S. G. S." The channel is straight for about 500 feet above and below the station. Both banks are high, but overflow at flood stages. The channel is divided by the center pier, and at low stages the current is sluggish with a slight reverse current on the south side of the river. The bench mark is an iron spike driven into the west side of the north abutment, about 2 feet from the south face and about 5 feet below the lowest bridge timber. Its elevation is 9 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

The following discharge measurement was made by R. W. Pratt in 1903:

July 6: Gage height, 2.00 feet; discharge, 170 second-feet.

Mean daily gage height, in feet, of Little Miami River near Morrow, Ohio, for 1903.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	3.10	2.60	1.60	1.30	17	5.30	3.20	1.55	.....
2	4.90	3.80	1.35	1.20	18	4.20	2.70	1.45	.....
3	5.70	4.70	1.50	1.15	9	3.50	2.55	1.40	.....
4	5.10	4.10	6.00	1.00	20	2.50	2.10	1.30	.....
5	3.10	3.40	4.15	1.05	21	2.40	3.30	1.40	.....
6	4.90	3.30	4.40	1.00	22	3.00	3.40	2.45	.....
7	5.70	2.90	4.85	1.00	23	4.00	3.20	1.55	.....
8	5.10	2.60	3.60	1.10	24	3.80	2.70	1.45	.....
9	4.70	3.80	3.80	1.00	25	3.90	2.20	1.30	.....
10	5.60	3.50	2.65	1.30	26	4.70	1.90	1.65	.....
11	5.90	3.30	2.15	1.15	27	3.20	1.55	2.05	.....
12	5.45	3.45	1.90	.....	28	2.80	2.25	1.70	.....
13	4.40	2.75	1.70	.....	29	2.50	3.40	1.55	.....
14	3.80	2.50	1.55	.....	30	2.60	2.20	1.40	.....
15	3.85	2.10	1.55	.....	31	.....	1.90	.....	.....
16	5.90	2.85	1.95	.....					

MISCELLANEOUS MEASUREMENTS IN LITTLE MIAMI RIVER DRAINAGE BASIN.

A measurement was made July 31, 1903, of the Little Miami River at Loveland, Ohio, by R. W. Pratt. The discharge was 105 second-feet. Water surface 21.3 feet below top of floor plank 10 feet west of intersection of top chord and floor, upstream side.

SCIOTO RIVER DRAINAGE BASIN.

Scioto River rises in the eastern part of Auglaize County, Ohio, flows east for about 40 miles and then almost due south, entering the Ohio at Portsmouth. Below Columbus, where it is joined by the Olentangy, it is one of the largest and most important streams in the State. The United States Geological Survey maintained stations on both Scioto and Olentangy rivers at Columbus for the purpose of studying the water supply and sewage disposal of that city. The river has considerable fall and flows through a hilly basin, forming numerous good locations for water-power developments. Its drainage area at Columbus is 1,051 square miles.

SCIOTO RIVER AT COLUMBUS, OHIO.

This station was originally established for the State board of health by B. F. Flynn, on the Grand View Avenue Bridge, 3 miles northwest of Columbus post-office, and was reestablished on the same bridge by R. W. Pratt, on November 21, 1903. This bridge is a two-span iron highway bridge, 250 feet between abutments. The initial point is the face of the easterly abutment on the downstream side, and the bridge is marked every 10 feet with double nails. The main channel is straight for about 100 feet above and 200 feet below, and there is a small island 150 feet above, which causes a side channel to enter the main channel at this point. The banks are high and only overflow in extreme floods. At low water the river is sluggish, but can be waded at several points below the bridge, where good measurements can be obtained. The following bench marks have been established:

Bench mark No. 1 is the upper side of the upper angle iron forming the lowest part of the hand rail above a point 1 foot east of the pulley. This point is 34.02 feet above the zero of the gage. Bench mark No. 2 is the extreme northeast corner of the north stone of the parapet wall of the east abutment. The elevation of this bench mark is 34.32 feet above the zero of the gage. Bench mark No. 3 is a nail in a telegraph pole 10 feet east of the east abutment at the north side. The elevation of this bench mark is 34.95 feet above the zero of the gage. The gage established by Mr. Pratt has its zero at the same elevation as the gage which was established by Mr. Flynn.

Discharge measurements of Scioto River at Columbus, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 6	E. C. Murphy	9.40	32
November 21	R. W. Pratt	9.37	83

Mean daily gage height, in feet, of Scioto River at Columbus, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Oct.	Nov.	Dec.
1	11.00	14.50	20.50	10.55	10.20	.....	9.00	9.20
2	11.20	14.05	17.85	10.45	10.15	.....	9.10	9.20
3	13.70	14.25	16.20	10.50	10.10	.....	9.10	9.20
4	13.60	18.00	14.65	13.15	10.00	.....	9.00	9.20
5	13.65	16.70	13.70	14.95	10.00	.....	9.15	9.20
6	12.95	15.10	12.90	14.35	9.95	.....	9.20	9.20
7	12.65	14.30	14.50	13.55	9.90	.....	9.00	9.10
8	12.40	13.70	17.00	12.85	9.90	9.45	9.00	9.10
9	12.05	13.25	16.70	12.40	9.80	9.50	9.00	9.10
10	12.30	12.70	16.95	11.75	9.80	9.25	9.15	9.10
11	11.75	12.35	17.25	11.30	9.70	9.35	9.20	9.20
12	11.60	12.90	15.55	11.55	9.70	9.25	9.15	9.10
13	11.55	13.50	14.35	12.50	9.65	9.25	9.05	9.20
14	11.40	13.15	13.45	14.45	9.60	9.20	9.20	9.20
15	11.40	13.80	12.90	14.40	9.55	9.25	9.20	9.20
16	11.35	13.40	12.75	13.70	9.50	9.20	9.20	9.20
17	11.10	12.25	13.65	13.35	9.50	9.20	9.60	9.20
18	10.80	12.70	12.85	12.45	9.50	9.10	9.70	9.20
19	10.80	13.20	12.30	11.75	9.50	9.10	9.50	11.60
20	10.80	13.00	11.95	11.30	9.50	9.10	9.40	11.40
21	10.80	12.45	13.05	10.95	9.50	9.10	9.40	11.15
22	10.60	12.00	12.60	10.75	9.50	9.10	9.30	11.50
23	10.55	11.25	11.95	10.55	9.50	9.00	9.20	10.10
24	10.40	11.05	11.40	10.50	9.55	9.00	9.20	10.30
25	10.45	10.95	11.15	10.40	9.70	9.00	9.20	10.10
26	10.50	11.10	11.05	10.40	9.80	9.10	9.20	10.25
27	10.50	12.95	10.85	10.40	9.75	9.10	9.20	10.25
28	12.10	19.85	10.65	10.40	9.95	9.10	9.10	10.10
29	15.50	.....	10.60	10.40	9.95	9.00	9.10	10.00
30	16.60	.....	10.60	10.30	9.85	9.00	9.10	10.00
31	15.45	.....	10.60	.....	.....	9.00	.....	9.85

OLENTANGY RIVER AT COLUMBUS, OHIO.

This station was established October 7, 1903, by R. Winthrop Pratt, in connection with the water supply and sewage disposal investigations of the city of Columbus. It is located 4 miles north of the Columbus, Ohio, post-office and one-fourth mile west of North High street at the Doddridge Street Bridge. The original station at Fifth Avenue Bridge, established by H. A. Pressey November 22, 1898, was abandoned August 18, 1903, on account of the sluggish flow and poor distribution of velocity. The boxed chain gage is bolted to the hand rail of the bridge on the upstream side. The observer is A. D. Winegardner. Discharge measurements are made from the two-span highway bridge and by wading below the bridge. The initial point for soundings is the east face of the west parapet wall. The channel is straight for 300 feet above and 500 feet below the station. The banks overflow only at high stages. The bed of the stream is of sand and clay. The drainage area at the station is 520 square miles.

Bench mark No. 1 is the northwest corner of the top stone of the north wing of the west abutment. Its elevation is 34.99 feet above gage datum. Bench mark No. 2 is a cut in the top of the hand rail

over the gage 31 feet from the initial point for soundings. Its elevation is 39.89 feet above the zero of the gage. Bench mark No. 3 is the center pin of the west end of the north truss; its elevation is 39.60 feet above the zero of the gage. The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Olentangy River at Doddridge Street Bridge, Columbus, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
October 7	R. Winthrop Pratt	6.20	13
November 21	do	6.56	51
December 23	do	7.00	211

Mean daily gage height, in feet, of Olentangy River at Fifth avenue, Columbus, Ohio, for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	2.20	3.50	9.05	1.80	1.70	17	2.40	3.20	2.60	2.90	1.40
2	2.20	2.85	6.05	1.80	1.70	18	2.40	3.20	2.75	2.35	1.40
3	4.35	4.00	3.35	1.90	1.70	19	2.40	3.20	2.35	2.10	1.40
4	5.35	7.40	3.05	4.50	1.70	20	2.40	3.20	2.60	2.05	1.40
5	4.20	6.00	2.85	4.20	1.70	21	2.40	3.20	3.25	1.90	1.40
6	3.80	4.30	3.15	3.40	1.70	22	2.40	3.20	3.05	1.80	1.40
7	2.40	2.65	3.45	2.50	1.70	23	2.40	3.20	2.50	1.80	1.40
8	2.40	2.50	5.80	2.45	1.70	24	2.40	3.20	2.35	1.80	1.40
9	2.40	2.75	5.20	2.60	1.60	25	2.40	3.20	2.25	1.80	1.50
10	2.40	2.40	5.80	2.35	1.50	26	2.40	3.20	2.10	1.80	1.55
11	2.40	2.40	5.60	2.10	1.50	27	2.40	3.85	1.95	1.90	1.80
12	2.40	3.40	5.10	2.55	1.50	28	3.05	8.70	1.85	1.90	1.95
13	2.40	3.25	3.65	2.90	1.50	29	7.60	.....	1.80	1.75	2.00
14	2.40	2.80	2.75	4.65	1.50	30	5.60	.....	1.75	1.70	1.75
15	2.40	2.75	2.40	5.05	1.50	31	4.20	.....	1.80	.....	.....
16	2.40	3.10	2.30	3.75	1.50						

Mean daily gage height, in feet, of Olentangy River at Doddridge street, Columbus, Ohio, for 1903.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	6.10	6.10	6.30	12	6.30	6.20	6.20	23	6.20	6.50	7.00
2	6.15	6.15	6.30	13	6.50	6.20	6.30	24	6.20	6.40	7.00
3	6.20	6.20	6.30	14	6.50	6.20	6.20	25	6.20	6.40	7.20
4	6.20	6.20	6.30	15	6.30	6.20	6.10	26	6.20	6.50	7.00
5	6.20	6.20	6.30	16	6.35	6.20	6.20	27	6.20	6.30	7.80
6	6.20	6.20	6.20	17	6.40	6.30	6.20	28	6.25	6.30	6.10
7	6.20	6.20	6.20	18	6.40	7.00	6.20	29	6.20	6.30	6.70
8	6.20	6.20	6.20	19	6.30	6.70	6.20	30	6.20	6.30	6.60
9	6.40	6.10	6.20	20	6.30	6.60	8.10	31	6.10	.....	6.50
10	6.40	6.20	6.20	21	6.30	6.40	7.30				
11	6.30	6.10	6.20	22	6.20	6.30	7.20				

M'MAHON RIVER DRAINAGE BASIN.

McMahon River rises in the eastern part of Harrison County, Ohio, flows southeast, and in a short course of about 20 miles joins the Ohio at Bellaire. This stream flows through a rough country, and, though small, is of interest as a possible water supply for the city of Bellaire.

During part of 1903 the United States Geological Survey maintained a station at Steel, where its drainage area is 82 square miles.

M'MAHON RIVER AT STEEL, OHIO.

This station is located on the single 88-foot span railroad bridge on the main line of the Baltimore and Ohio Railroad 200 feet west of the station at St. Clairsville Junction, and was established by R. W. Pratt June 24, 1903.

A short distance below this bridge water is pumped for use of the railroad and the gage is placed in their well. At low water this stream is measured some distance below the bridge by wading. At the bridge the stream is prevented from overflowing by railroad embankments on both sides, and the bottom is fairly constant. This stream was found to have such a small discharge during the dry months that it did not warrant the expense incurred in carrying it on, and it was discontinued.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of McMahon River at Steel, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 24	R. W. Pratt	4.20	65
March 11	E. Johnson, jr.	5.50	525

Mean daily gage height, in feet, of McMahon River at Steel, Ohio, for 1903.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1		3.80	9		3.70	17		3.60	25	4.05	3.60
2		3.80	10		3.70	18		3.60	26	3.80	
3		3.70	11		3.80	19		3.60	27	3.65	
4		3.70	12		3.60	20		3.70	28	3.80	
5		3.70	13		3.80	21		3.70	29	3.90	
6		4.15	14		3.80	22		3.80	30	3.70	
7		3.80	15		3.80	23		3.60	31		
8		3.75	16		3.70	24		3.60			

CROSS CREEK DRAINAGE BASIN.

Cross Creek rises in the northeastern corner of Harrison County and flows east and joins Ohio River a few miles south of Steubenville, Ohio. This stream flows near the city of Steubenville and through

Mingo Junction, an important industrial settlement, and the measurements of its flow are of importance in determining the available water supply for these municipalities. This river drains a territory of 129 square miles.

CROSS CREEK NEAR MINGO JUNCTION, OHIO.

This station was established May 22, 1903, by R. Winthrop Pratt. It was discontinued September 23, 1903, on account of sluggish flow and poorly distributed velocity. It was located at the Pennsylvania Railroad bridge, a stone arch bridge 1½ miles west of Mingo Junction railroad station. The gage was a 1 by 6 inch pine board, spiked to the first pier at the east end of the bridge. The gage was read once each day by George Mayberry. Discharge measurements can be made from the railroad bridge or by wading at low water. The initial point for soundings is the downstream corner at the west end of stone bridge. The bed of the stream consists of gravel and small rocks, and probably changes during floods. The bench mark is a cut on the northeast corner of the east pier. Its elevation is 4.00 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Cross Creek near Mingo Junction, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 24	R. W. Pratt	2.35	233
August 11	do	1.20	10

Mean daily gage height, in feet, of Cross Creek near Mingo Junction, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1		1.40	1.50	1.20	1.10	17		1.45	1.30	1.05	1.00
2		1.35	1.50	1.20	1.10	18		1.45	1.50	1.05	1.00
3		1.35	1.50	1.20	1.10	19		1.45	1.80	1.00	.95
4		1.30	1.40	1.20	1.05	20		1.93	1.60	1.00	.95
5		1.30	1.80	1.10	1.05	21		1.90	1.50	1.00	.95
6		1.40	1.50	1.10	1.00	22	1.40	1.75	1.40	1.00	.95
7		1.45	1.40	1.30	1.00	23	2.30	4.25	1.30	1.00	.95
8		2.10	1.40	1.30	1.00	24	1.70	2.40	1.30	1.00	.95
9		1.50	1.30	1.25	1.00	25	1.60	2.10	1.20	.95	.95
10		1.40	1.30	1.25	1.00	26	1.55	1.80	1.20	1.00	.95
11		1.35	1.50	1.20	1.15	27	1.55	1.75	1.20	1.05	.95
12		1.30	1.50	1.20	1.10	28	1.45	1.70	1.20	1.20	.90
13		1.65	1.45	1.20	1.10	29	1.40	1.65	1.20	1.60	.90
14		2.00	1.40	1.10	1.05	30	1.40	1.60	1.30	1.30	.90
15		1.75	1.40	1.10	1.00	31	1.40		1.30	1.20	
16		1.55	1.40	1.05	1.00						

MAHONING RIVER DRAINAGE BASIN.

Mahoning River rises in the northwestern part of Columbiana County, Ohio, flows north, then turns southeast, entering Ohio River at Beaver, in Beaver County, Pa. This river flows through a hilly and important territory. There are numerous water-power developments on it, and it forms an important adjunct in the water supply and sewage disposal of numerous towns along its course. Among them is Youngstown, Ohio, where the United States Geological Survey station is maintained. Its drainage area at Youngstown is 958 square miles.

MAHONING RIVER AT YOUNGSTOWN, OHIO.

This station was established May 23, 1903, by R. Winthrop Pratt, and is located about 2 miles below the center of the city of Youngstown, at the highway bridge near the plant of the Hazelton Steel Company. The vertical gage, consisting of a 1-inch by 6-inch board nailed to stakes driven in the river bed 15 feet from the east abutment, was used up to September 23, 1903, at which time a standard chain gage was installed. The gage is read once each day by John McVean. Discharge measurements are made from the single-span highway bridge, to which the gage is attached. The initial point for soundings is the face of the parapet wall of the east abutment on the upstream side. The channel is straight for about 2,000 feet above and 1,000 feet below the bridge and is 200 feet wide between abutments. Both banks are high and are subject to overflow only at high water. The section is fairly regular and the bed of the stream is composed of gravel and small bowlders, probably not subject to change.

Bench mark No. 1 is the top of the copper plate on the face of the east abutment near the upstream corner. It is 9.37 feet above gage datum. Bench mark No. 2 is the northwest corner of the bridge seat of the west abutment. It is 17.12 feet above gage datum. Bench mark No. 3 is a cut in the end stone of the second tier from the top of the north wing wall of the west abutment. It is 21.34 feet above gage datum. Bench mark No. 4 is a cut in the top hand rail at a point 35 feet from the east abutment on the upstream side. It is 25.88 feet above gage datum. The elevation of the center of the pulley on which the chain of the gage runs is 23.61 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. Johnson, jr., district hydrographer.

Discharge measurements of Mahoning River at Youngstown, Ohio, in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 9	E. Johnson	10.80	14,095
July 16	R. W. Pratt	.65	151
August 7	E. C. Murphy	.90	216
September 23	R. W. Pratt	.62	149
October 27	do	.77	167
November 24	do	1.10	295
December 16	do	1.00	262

Mean daily gage height, in feet, of Mahoning River at Youngstown, Ohio, for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.70	1.20	1.80	3.15	0.45	0.60	0.90
2		.85	1.15	1.50	2.75	.55	.65	.90
3		.70	1.00	1.50	2.30	.60	.70	.85
4		.70	1.00	1.40	1.85	.50	.65	.75
5		.70	.95	.90	1.35	.55	.95	.70
6		.65	.80	1.00	1.20	.60	.75	.75
7		.75	.70	.70	1.05	.45	.70	.85
8		1.15	.75	1.10	1.00	1.50	.50	.75
9		1.35	.70	.90	1.10	2.45	.65	.75
10		1.15	.70	.70	1.20	2.25	.80	.90
11		1.00	.70	.80	1.40	1.80	.75	.95
12		.80	.50	.80	1.40	1.55	.70	.80
13		.80	.60	.70	1.30	1.55	.75	.80
14		1.10	.70	.70	1.10	1.35	.85	.75
15		1.35	.60	.70	1.10	1.10	.70	.90
13		1.35	.60	.70	.90	1.05	.75	.90
17		1.00	.60	.60	.90	.85	2.35	.80
18		1.00	1.30	.60	.80	.80	3.60	.70
19		.90	1.00	.60	.70	.75	2.90	.90
20		.85	1.70	.50	.70	.90	2.15	.90
21		.60	1.90	.40	.70	.85	1.50	1.40
22		.65	2.00	.40	.60	.85	1.10	2.05
23		1.55	2.20	.30	.65	.85	1.15	2.05
24	0.75	1.65	1.80	.30	.65	.80	1.05	1.85
25	.80	1.55	1.40	.40	.65	.80	1.00	1.60
26	.95	1.20	1.10	.40	.35	.75	1.05	1.50
27	.80	1.00	.90	.70	.40	.75	1.00	1.40
28	.80	.95	.70	6.70	.50	.65	.95	1.30
29	.70	1.00	.70	8.00	.40	.65	1.00	1.15
30	.70	1.10	1.00	6.30	.40	.45	.95	1.05
31	.60		2.00	4.40		.50		1.00

ALLEGHENY RIVER DRAINAGE BASIN.

Allegheny River rises in Potter County, Pa., and unites with Monongahela River at Pittsburg to form the Ohio. Its sources are adjacent to those of Susquehanna and Genesee rivers. It flows west and north, entering New York State near the southeast corner of Cattaraugus County, and, making a bend across the county, it again enters Pennsylvania at a point near the southwest corner of Cattaraugus County.

The drainage basin is rugged and largely timber covered. On Allegheny River near the gaging station the banks rise abruptly several feet above the stream on either side closely adjacent to the river. The stream valley itself is broad and flat, varying from 1 to 2 miles in width, and the current, as a rule, is sluggish. The plateaus from which the stream receives its drainage are deeply dissected by tributaries and are very irregular in contour. The soil is, as a rule, impervious, and dry gulleys are numerous.

Chautauqua Lake extends in a northwesterly and southeasterly direction, having its head at a distance of 8 miles from Lake Erie. Its water surface is at an elevation of 1,308 feet above sea level or 735 feet above Lake Erie. Its outlet at the southeast end, near the city of Jamestown, is known as the Chadakoin River, and furnishes water power at numerous dams, entering Allegheny River in Pennsylvania through Conewango Creek. The drainage area above the foot of the lake is 190.6 square miles, of which 20.8 square miles comprise the lake surface, which represents 10.4 per cent of the drainage area. The land area tributary to the lake is very rolling and the soil impervious.

At Olean the wasteway from Cuba reservoir enters the Allegheny through Olean Creek. This reservoir is located on the divide between Oil Creek, tributary to Allegheny River, and Genesee River. The storage is commonly turned into Genesee River through the abandoned summit level of Genesee Valley Canal, but may be diverted into Oil Creek through the guard lock at the head of the canal.

ALLEGHENY RIVER AT REDHOUSE, N. Y.

This station was established September 4, 1903, by R. E. Horton, assisted by C. C. Covert. It is located at the Redhouse bridge near the stations of the Erie and Pennsylvania railroads and about 5 miles below Salamanca, N. Y., and about 13 miles above the point where the river leaves New York State. The standard chain gage is fastened to the upstream side of the bridge near the middle of the left span. The length of the chain from the end of the weight to the marker is 24.16 feet. The gage is read twice each day by James H. Smith. Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the left end of the downstream side of the bridge. The channel is straight for 800 feet above and below the bridge. The current velocity is well distributed. The

right bank is high and does not overflow. The left bank overflows only at flood stages. The bed of the stream is of gravel, and is regular. The channel is 494 feet wide between abutments, broken by two piers. At extreme high water there is an additional flood channel on the left bank. The bench mark is a circle cut on the downstream side of the left abutment. Its elevation is 21.09 feet above the water surface when the gage reads zero.

The observations at this station during 1903 have been made under the direction of R. E. Horton, district hydrographer.

Discharge measurements of Allegheny River at Redhouse, N. Y., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 4	R. E. Horton	4.33	1,909
August 29	C. C. Covert		[a] 6,844
September 3	do		[b] 1,312

[a] High-water measurement at Union Street Bridge, Olean, N. Y.
[b] High-water measurement at highway bridge near Portville, N. Y.

Mean daily gage height, in feet, of Allegheny River at Redhouse, N. Y., for 1903.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		3.35	3.70	4.05	17	3.70	4.15	7.30	4.20
2		3.70	3.70	4.00	18	5.00	4.15	7.95	4.20
3		3.85	3.60	3.85	19	4.60	4.70	7.30	4.20
4	4.35	3.70	3.60	3.75	20	4.22	4.50	6.45	4.22
5	4.15	4.28	3.60	3.65	21	4.05	4.30	6.25	4.25
6	4.00	4.60	3.70	3.60	22	3.90	4.22	5.80	4.25
7	3.88	4.32	3.90	3.60	23	3.75	4.20	5.32	4.25
8	3.82	5.00	3.70	3.60	24	3.70	4.10	5.18	4.22
9	3.78	7.05	3.65	3.60	25	3.58	4.00	5.00	4.25
10	3.70	6.35	3.60	3.60	26	3.50	3.85	4.65	([a])
11	4.40	5.75	3.60	3.55	27	3.50	3.85	4.45	
12	5.00	5.20	3.65	3.50	28	3.40	3.65	4.35	
13	4.25	4.82	3.70	3.50	29	3.42	3.80	4.25	
14	4.15	4.55	3.70	3.50	30	3.35	3.80	4.20	
15	3.85	4.35	3.60	3.50	31		3.70		
16	3.75	4.25	3.60	4.10					

[a] Stream frozen over.

MISCELLANEOUS MEASUREMENTS IN THE ALLEGHENY RIVER DRAINAGE BASIN.

The following measurements of the outflow from the lake in the unusually dry summer season of 1895 were made by E. C. Burns. The measurements of July, 1895, were made by means of floats; the later measurements were all by current meter. Some fall exists in the outlet from the foot of the lake to the first dam, the lake outflow being probably unregulated.

Discharge of Chautauqua Lake Outlet, Jamestown, N. Y., 1895.

[Drainage area, 190.6 square miles.]

Date.	Second-feet.	Second-feet per square mile.	Date.	Second-feet.	Second-feet per square mile.
July 18	83.9	0.44	Sept. 2	46.3	0.24
July 20	135.3	.71	Sept. 3	80.4	.42
July 21	42.7	.22	Sept. 4	64.2	.34
July 22	68.8	.36	Sept. 5	40.7	.21
July 23	71.9	.38	Sept. 6	43.8	.22
July 28	53.6	.28	Sept. 10	43.8	.22
July 30	98.8	.52	Sept. 13	62.0	.32
July 31	105.3	.55	Sept. 18	71.6	.38
Aug. 16	106.1	.56	Sept. 20	41.8	.22
Aug. 17	78.2	.41	Sept. 24	68.3	.36
Aug. 18	87.9	.46	Sept. 26	86.6	.45
Aug. 19	93.0	.48	Oct. 9	47.8	.25
Aug. 20	88.5	.46	Oct. 10	43.0	.22
Aug. 21	82.8	.43	Oct. 11	48.0	.25
Aug. 26	92.3	.48	Oct. 12	41.9	.22
Aug. 27	96.0	.50	Oct. 13	34.6	.18
Aug. 28	78.5	.41	Oct. 14	47.7	.25
Aug. 29	62.4	.32	Oct. 15	43.7	.22
Aug. 30	88.2	.46	Oct. 16	[a] 66.0	.34
Aug. 31	113.1	.59	Oct. 17	[b] 36.0	.18

[a] Strong wind down the lake. [b] Wind up the lake.

Stream measurements have been furnished by F. W. Dalrymple, C. E.

The following additional measurements have been made:

Date.	Second-feet.	Second-feet per square mile.
April 30, 1902	466.0	2.45
September 6, 1903 [a]	130.6	.69

[a] By R. E. Horton. Steel Street Bridge. Water surface 12.54 feet below downstream corner right-hand abutment coping, on downstream side of bridge.

MONONGAHELA RIVER DRAINAGE BASIN.

Monongahela River rises in the central part of West Virginia and, flowing north, crosses into Pennsylvania. At Pittsburg it unites with the Allegheny, forming the Ohio. Its principal tributaries are the Youghiogheny, which flows into it about 15 miles above Pittsburg,

and the Cheat, which joins it just north of the Pennsylvania line. Under the direction of E. G. Paul the United States Geological Survey is maintaining a station on the Youghiogheny, at Friendsville, Md., and one on the Cheat, at Uneva, near Morgantown, W. Va.

YOUGHIOGHENY RIVER AT FRIENDSVILLE, MD.

Youghiogheny River rises in Garrett County, Md., and flows in a northwesterly direction into Pennsylvania, where it empties into Monongahela River 15 miles above Pittsburg. Its source is on the western slope of the Allegheny Mountains, at an elevation of about 2,900 feet. The average fall of the stream for 19 miles above its mouth is about 2 feet per mile, but above this point it soon increases to an average fall of nearly 5 feet per mile. The bank height above low water ranges between 15 and 28 feet, and the average width between banks from the mouth to West Newton, Pa., is 546 feet. The following heights of the high water of February, 1897, above low-water stage, at various points in Pennsylvania, were furnished by George M. Lehman: Whikett, 13 feet; Jacobs Creek, 10 feet; Smithton, 14 feet; Port Royal, 17 feet; Snyder, 16 feet; West Newton, 20 feet; Suterville, 22 feet; Buena Vista, 26.5 feet; Coulterville, 28.5 feet; Boston, 29 feet; McKeesport, 28.5 feet.

A measurement of Youghiogheny River was made October 13, 1892, with surface floats, at Ohiopyle, Pa., by Kenneth Allen, in connection with an investigation of a water supply for the works of the H. C. Frick Coke Company. It was during a period of extreme drought, and the discharge was found to be 106 second-feet.

The station at Friendsville, Md., was established by E. G. Paul on August 17, 1898. The standard chain gage is located on the upstream side of the right span of the bridge and is nailed to the guard rail. The length of the chain from the end of the weight to the marker is 20 feet. The initial point for soundings is a point 15 feet back from the face of the right abutment on the upstream side of the bridge. Measurements are made from the iron highway bridge connecting the east and the west portions of the village. The channel is straight for several hundred feet above and below the bridge. The bed is rocky and the banks are high and not subject to overflow. The observer is J. H. Cuppet, a merchant residing within a short distance of the gage.

Bench mark No. 1 is a United States Geological Survey bench mark consisting of an aluminum tablet disk marked "1501," in the foundation corner stone of the southeast corner of Friend's store. The elevation of this bench mark is 33.17 feet above gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurement was made by E. G. Paul:

September 3: Gage height, 4.10 feet; discharge, 124 second-feet.

Mean daily gage height, in feet, of Youghiogheny River at Friendsville, Md., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.00	7.80	7.50	5.20	4.80	5.20	6.20	4.40	4.20	3.70	3.90	4.30
2	6.00	7.50	7.00	5.30	4.90	5.20	5.80	4.50	4.10	3.70	3.90	4.30
3	6.80	7.40	6.50	5.20	4.90	5.20	5.50	4.30	4.10	3.70	4.00	4.30
4	7.80	8.00	6.10	5.20	4.90	5.30	5.50	4.20	4.10	4.00	4.00	4.30
5	6.90	8.00	5.80	5.20	4.90	5.30	5.50	4.30	4.00	4.20	4.00	4.30
6	6.30	7.00	5.80	5.30	4.80	5.40	5.40	4.30	4.00	4.30	4.00	4.30
7	5.90	6.20	5.80	5.50	4.70	5.50	5.30	4.30	4.00	4.50	4.00	4.30
8	5.40	6.00	5.90	5.80	4.70	5.50	5.20	4.20	4.10	4.50	4.00	4.30
9	5.00	6.00	6.00	7.00	4.50	5.10	5.30	4.20	4.10	4.80	4.00	4.30
10	5.20	5.80	6.00	6.80	4.50	4.80	5.40	4.10	4.10	4.60	4.00	4.30
11	5.80	5.20	6.20	6.40	4.40	5.00	5.50	4.10	4.00	4.50	4.00	4.30
12	5.70	5.20	7.00	6.00	4.40	5.20	5.60	4.10	4.00	4.30	4.20	4.30
13	5.50	6.00	7.50	5.60	4.40	6.00	5.50	4.10	4.00	4.30	4.60	4.30
14	5.40	5.80	6.90	5.60	4.40	6.60	5.50	4.10	4.00	4.20	4.70	4.30
15	5.20	6.50	6.00	5.60	4.30	6.80	5.40	4.00	4.00	4.20	4.90	4.30
16	5.10	9.00	5.20	5.50	4.30	6.70	5.20	4.10	3.90	4.20	5.00	4.30
17	5.00	8.50	5.20	5.50	4.30	6.40	5.10	4.10	3.90	4.30	5.60	4.30
18	5.00	6.50	5.20	5.50	4.20	6.40	5.20	4.20	3.90	4.20	5.20	4.30
19	5.00	6.20	5.20	5.50	4.20	6.20	5.10	4.30	3.90	4.10	4.90	4.30
20	4.90	5.90	5.10	5.40	4.20	6.10	5.30	4.30	3.90	4.10	4.70	4.30
21	4.70	5.50	5.10	5.30	4.60	6.20	5.20	4.20	3.80	4.10	4.60	4.30
22	4.70	5.50	5.80	5.30	4.80	6.00	5.20	4.30	3.80	4.10	4.50	4.30
23	4.80	5.30	6.20	5.20	5.00	6.30	5.10	4.20	3.80	4.10	4.50	4.30
24	4.80	5.10	8.20	5.00	5.20	6.40	4.90	4.10	3.80	4.00	4.40	4.30
25	4.90	5.00	8.00	5.00	5.30	6.40	4.70	4.20	3.80	4.00	4.40	4.30
26	5.00	5.20	6.00	4.90	5.40	6.30	4.60	4.30	3.80	4.00	4.40	4.30
27	5.30	5.90	5.80	4.80	5.50	7.10	4.50	4.40	3.80	4.00	4.30	4.30
28	5.70	8.00	5.50	4.80	5.30	7.40	4.30	4.50	3.80	4.00	4.30	4.30
29	7.20	.....	5.40	4.80	5.40	8.50	4.20	4.40	3.70	4.00	4.30	4.30
30	8.30	.....	5.40	4.70	5.30	7.90	4.20	4.30	3.70	4.00	[a] 4.30	4.30
31	8.00	.....	5.30	.....	5.20	.....	4.30	4.20	.....	3.90	.....	4.30

[a] To top of ice remainder of year.

Rating table for Youghiogheny River at Friendsville, Md., for 1902 and 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.6	12	4.6	340	5.6	1,150	7.5	3,310
3.8	45	4.8	464	5.8	1,372	8.0	3,880
4.0	90	5.0	600	6.0	1,600	9.0	5,020
4.2	150	5.2	770	6.5	2,170		
4.4	230	5.4	955	7.0	2,740		

Estimated monthly discharge of Youghiogheny River at Friendsville, Md., for 1903.

[Drainage area, 295 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,222	400	1,330	4.51	5.20
February	5,020	600	2,110	7.16	7.46
March	4,108	685	1,718	5.82	6.71
April	2,740	400	1,025	3.47	3.87
May	1,050	150	478	1.62	1.87
June	4,450	464	1,725	5.85	6.53
July	1,828	150	781	2.65	3.06
August	280	90	167	.57	.66
September	150	25	78	.26	.29
October	464	25	148	.50	.58
November[a]	1,150	65	271	.92	1.03

[a] River frozen November 30 to January 1.

CHEAT RIVER NEAR MORGANTOWN, W. VA.

A cable station was established July 8, 1899, by E. G. Paul, at Uneva, near Morgantown, W. Va. The cable was moved about 1 mile downstream, to secure a more satisfactory cross section and better facilities for observing gage heights, on July 26, 1901. An inclined timber gage was established at the present station August 21, 1902. It is located 275 feet below the cable and is inclined up to 6.5 feet, above which point readings are taken on a vertical timber spiked to an ash tree. The station is located 7 miles from Morgantown and 1 mile below Ices' ferry bridge. Discharge measurements are made from the cable secured to a sycamore tree on the right bank and timber supports on the left bank. The channel is straight for about 800 feet above and 1,200 feet below the station. The right bank is low and liable to overflow; the left bank is high. The bed of the stream is of rocks and gravel and the current is sluggish. The bench mark is a mark on the face of a sandstone rock at the edge of the road, 20 feet downstream and 30 feet back from the gage. Its elevation above gage datum is 21.13 feet.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurement was made by E. G. Paul:

September 1: Gage height, 2.30 feet; discharge, 682 second-feet.

Mean daily gage height, in feet, of Cheat River near Morgantown, W. Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.95	6.15	10.55	3.70	3.15	3.25	5.65	2.25	2.25	1.40	1.50	1.85
2	3.75	6.40	6.95	3.80	3.05	2.95	5.25	2.80	2.20	1.40	1.50	1.85
3	10.10	7.35	5.60	3.80	3.00	3.00	4.10	2.70	2.15	1.40	1.50	1.90
4	8.60	9.20	4.90	4.05	3.00	2.70	3.65	2.50	2.00	1.40	1.50	1.90
5	6.70	8.80	4.55	5.35	3.25	2.50	3.85	2.35	1.80	1.55	1.55	1.80
6	5.50	6.35	4.50	4.60	3.05	2.50	4.60	2.10	1.80	1.85	1.75	1.80
7	4.80	5.35	4.75	4.45	2.90	3.50	3.95	2.30	1.70	1.85	1.90	1.80
8	4.35	4.80	7.10	6.65	2.75	5.65	3.70	2.10	1.70	1.70	2.15	1.75
9	3.60	4.60	8.25	8.35	2.70	4.65	3.20	2.10	1.70	3.05	2.05	1.70
10	3.30	4.10	6.65	6.45	2.55	3.95	2.95	2.00	1.80	3.10	1.90	1.75
11	3.40	3.95	5.70	5.45	2.50	3.60	3.45	1.95	1.80	2.65	1.85	1.90
12	5.95	5.05	5.30	5.05	2.50	4.80	3.95	1.90	1.75	2.25	1.80	1.65
13	4.90	5.75	4.95	4.95	2.35	6.80	4.75	1.90	1.65	2.10	1.75	1.80
14	5.35	4.95	4.35	4.75	2.30	7.00	5.30	1.75	1.60	2.25	1.70	2.25
15	5.60	5.75	4.05	4.60	2.25	7.20	4.40	1.75	1.50	2.10	1.70	2.25
16	4.10	11.10	3.90	5.50	2.45	5.85	3.70	1.70	1.50	2.00	1.70	2.40
17	3.85	8.25	3.80	5.50	2.35	4.75	3.25	1.70	1.50	1.90	2.20	2.20
18	3.55	6.10	3.60	5.50	2.25	4.10	3.25	1.70	1.50	1.90	5.25	2.20
19	3.20	4.85	3.40	4.95	2.20	3.70	3.20	1.80	2.00	2.05	4.15	2.00
20	3.00	4.75	3.25	4.40	2.10	3.50	4.05	1.85	2.55	2.35	3.25	2.10
21	3.40	4.15	4.35	4.05	2.05	4.85	4.30	1.80	2.05	2.20	2.75	4.00
22	3.80	4.00	5.20	3.90	1.95	4.55	3.45	2.50	1.85	2.10	2.50	3.90
23	3.65	3.60	7.80	3.65	2.80	4.65	3.05	2.15	1.70	2.00	2.50	3.45
24	3.40	3.80	9.50	3.45	3.50	5.30	2.75	1.95	1.65	1.90	2.40	3.00
25	3.30	3.85	6.50	3.55	4.25	4.40	2.50	1.75	1.60	1.80	2.25	4.45
26	3.15	3.70	5.35	3.55	5.80	3.70	2.30	1.70	1.50	1.65	2.25	5.35
27	3.20	3.95	4.60	4.05	6.40	3.30	2.20	1.70	1.50	1.70	2.05	4.05
28	6.15	11.30	4.20	3.80	5.05	3.75	2.00	1.75	1.50	1.70	2.05	3.50
29	8.50	.....	3.80	3.55	4.30	8.50	2.00	1.75	1.50	1.70	1.90	3.15
30	8.65	.....	3.70	3.30	3.85	7.35	2.05	1.75	1.40	1.60	1.90	3.15
31	8.16	.....	3.70	.....	3.60	.....	2.00	2.25	.....	1.60	.....	2.85

KANAWHA RIVER DRAINAGE BASIN.

Kanawha River flows north through West Virginia, joining the Ohio River at Point Pleasant, W. Va. In its upper course it is known as New River, which rises in Watauga, Ashe, and Alleghany counties, N. C. The area of the latter two counties is comprised wholly within the drainage basin of New River; their boundaries, being along the mountain ridges, form the divides between the drainage basin of this river and Yadkin River on the east and of Holston River on the west. The general direction of the river is northwesterly. At first the upper tributaries have a general northeasterly and southwesterly direction, draining narrow valleys of the Greater Appalachian Valley in Virginia. The main river cuts the Alleghany fronts just below Pearisburg, Va., and the remainder of the drainage area is confined to the State of West Virginia. For some distance the basin divide follows the State line between Virginia and West Virginia, both north and south of the point where the river pierces the Alleghany

front. The basin of New River is as beautiful and picturesque a section of country as any in the eastern part of the United States. The river itself is rapid. The country on its lower courses, through which the Chesapeake and Ohio Railway passes, is noted for its scenic beauty.

The principal tributaries of New River are Little River, which empties near Radford, Va., and the Greenbrier, which rises in the eastern part of West Virginia and joins the New at Hinton, W. Va. The following is a list of the stations maintained in this drainage basin by the United States Geological Survey, under the supervision of E. G. Paul: New River at Fayette, W. Va.; Greenbrier River at Alderson, W. Va.; New River at Radford, Va.; New River near Oldtown, Va.

NEW RIVER AT FAYETTE, W. VA.

This station, established by C. C. Babb and D. C. Humphreys July 29, 1895, is located just below the mouth of Wolf Creek, on the highway bridge of one span at Fayette, W. Va. The wire gage was located on the guard rail on the upper side of the bridge, about the middle of the span, the scale being graduated to feet and tenths. The gage is referred to four bench marks: First, the top of the bottom plate of the lower plate girder at the end of the first panel from the right bank, downstream side, 55.13 feet above the zero of the gage; second, the top of the lower end of the coping on the main pier, right bank, downstream side, 52.13 feet above the zero of the gage; third, the bridge seat on the right bank, downstream side, 54.58 feet above the zero of the gage; fourth, the west corner of the abutment stone by the Chesapeake and Ohio Railway station, 58.62 feet above the zero of the gage. A temporary bench mark, established when the chain gage was installed, is the top of the bottom plate of the plate girder 0.5 foot south of the gage box. Its elevation is 52.63 feet above gage datum. The channel is straight above and below the station. The current is swift and without obstructions, except for immense bowlders in the bottom. The banks are high, rocky, and not subject to overflow. The bed is constant in section. The observer is J. R. Durrett, a clerk in the store at Fayette, W. Va. The station was discontinued May 22, 1901. On August 11, 1902, it was reestablished. On November 20, 1903, a standard chain gage was installed by W. C. Sawyer. It occupies the same position as the old wire gage, which it replaced, and it has the same datum. The length of the chain from the end of the weight to the marker is 59 feet.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

In 1903 the following discharge measurements were made by E. G. Paul and W. C. Sawyer:

September 21: Gage height, 3.20 feet; discharge, 3,968 second-feet.

Mean daily gage height, in feet, of New River at Fayette, W. Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	8.02	21.60	9.90	11.20	5.70	7.70	6.70	1.75	1.35	1.30	0.20
2	8.40	7.03	15.00	9.70	9.85	6.10	6.40	7.70	1.75	1.25	1.45	.10
3	17.20	7.45	12.10	9.50	9.80	5.65	5.55	7.40	1.80	1.25	1.55	.00
4	15.10	11.60	9.00	8.60	9.15	5.30	5.75	5.90	2.85	1.35	1.45	.90
5	7.60	17.70	8.00	6.30	9.10	5.80	5.65	6.30	1.80	1.25	1.55	1.00
6	4.30	11.10	6.70	5.80	10.25	6.20	5.30	6.50	1.75	1.25	1.45	.95
7	4.80	9.30	6.30	7.10	9.10	9.50	5.05	6.80	1.85	1.35	1.85	.90
8	4.10	8.00	8.10	10.10	9.20	9.00	5.00	6.60	1.95	1.45	1.55	1.00
9	4.00	7.20	9.00	12.90	9.81	7.95	4.80	5.80	2.15	1.55	2.05	1.10
10	3.75	6.40	11.30	9.80	9.30	7.70	4.80	5.50	2.05	3.65	1.50	.90
11	3.60	5.40	11.00	8.70	9.70	6.80	4.85	3.30	2.95	3.05	1.25	.75
12	3.10	8.30	10.80	6.60	9.20	6.45	6.20	3.05	1.85	2.75	1.55	.55
13	3.15	11.00	10.30	5.50	9.05	6.35	8.65	2.95	2.15	2.65	1.45	.30
14	2.90	9.20	9.50	9.60	8.75	6.75	9.85	2.85	2.05	2.45	1.40	.15
15	2.80	10.20	9.30	11.20	8.00	6.65	10.70	2.95	1.95	2.05	1.65	.10
16	2.85	11.40	8.00	10.10	7.95	5.85	10.00	2.35	1.80	1.75	1.55	.10
17	3.40	12.20	7.60	8.70	7.75	5.85	9.30	2.15	2.05	1.55	.95	.05
18	3.55	17.20	7.50	8.10	7.90	4.50	7.10	2.05	2.20	1.20	.....	.00
19	3.80	10.60	6.00	7.60	6.70	4.80	5.70	2.00	2.15	1.45	1.40	.00
20	4.35	9.10	5.20	7.20	5.90	4.90	5.40	2.00	.80	2.00	1.40	.00
21	5.05	8.70	4.80	7.10	5.80	4.85	5.20	1.95	1.95	1.50	2.25	.20
22	4.20	8.60	5.00	7.70	5.80	4.75	5.05	1.90	2.55	1.35	1.60	1.20
23	4.35	7.00	22.40	7.00	5.80	5.00	4.85	1.95	1.65	1.65	1.25	1.20
24	7.80	6.50	31.80	6.70	5.70	5.65	3.75	1.90	1.55	.95	.95	1.30
25	4.60	5.30	19.70	7.80	5.00	5.40	3.70	1.90	1.45	.70	.95	1.30
26	6.00	4.60	11.70	9.85	4.75	5.60	3.70	2.05	1.50	1.25	.85	1.20
27	8.40	7.00	9.70	18.00	4.10	5.70	3.20	2.10	1.55	1.45	.75	1.20
28	9.30	9.60	8.80	12.85	3.80	7.10	3.20	2.05	1.45	1.45	.65	1.30
29	10.04	.....	8.10	11.90	3.75	11.40	3.80	2.00	1.35	1.35	.25	1.45
30	13.01	.....	8.70	12.10	3.80	8.35	5.00	2.90	1.25	1.15	.20	1.60
31	12.04	.....	10.10	.....	5.30	.....	6.30	1.80	.....	1.35	.....	1.60

GREENBRIER RIVER AT ALDERSON, W. VA.

Greenbrier River rises on the western slope of the Allegheny Mountains, in Pocahontas County, W. Va., and flows in a southwesterly direction, emptying into New River near Hinton, Summers County, W. Va. The station was established by C. C. Babb and D. C. Humphreys, at Alderson, W. Va., 21 miles above Hinton, August 1, 1895. Greenbrier River receives many short tributaries from the Allegheny Range, and flows for the most part through a broken, hilly, and mountainous country well covered with forests. The station is located one-half mile above the mouth of Muddy Creek, on the county bridge at Alderson. The wire gage was located in the third panel of the second span, downstream side of the bridge. This gage was referred to three bench marks: The first, on the upper end of the coping of the first pier from the left bank, 21.75 feet above gage datum; the second, on the upper end of the bridge seat of the left-bank abutment, 21.61 feet above gage datum; the third, on the stone foundation of the water tank of the Chesapeake and Ohio Railway, 23.48 feet above gage

datum. A temporary bench mark has been established on the lower end of the third floor beam, in the second span from the left bank. Its elevation is 22.47 feet above gage datum. On November 20, 1903, a standard chain gage was installed by W. C. Sawyer. It occupies the same position as the wire gage which it replaced and its datum is the same. The length of the chain from the end of the weight to the marker is 27.81 feet. A new bench mark, to which this gage is referred, is the top of the water table at the northwest corner of the Merchants' Grocery Company building. Its elevation is 21.71 feet above gage datum. The bridge consists of four spans 435 feet long. At ordinary stages the water flows in two channels, between which is an island 600 feet long and 75 feet wide. The initial point for soundings is the center of the pin on the downstream side of the bridge, on the left bank. The banks are high and not subject to overflow. The bed is of rock and gravel and fairly constant. The observer is W. J. Hancock, merchant at Alderson, W. Va.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of Greenbrier River at Alderson, W. Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 21	Paul and Sawyer	2.03	373
November 16	W. C. Sawyer	1.73	130

Mean daily gage height, in feet, of Greenbrier River at Alderson, W. Va., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.28	4.92	10.00	3.55	3.40	2.50	3.33	1.95	1.93	1.65	1.70	1.60
2	2.39	4.10	5.88	3.30	3.15	3.10	2.90	2.25	1.75	1.70	1.65	1.65
3	9.94	4.50	4.46	3.17	2.95	2.70	2.65	2.45	1.73	1.65	1.65	1.70
4	7.22	7.45	3.93	3.17	2.80	2.50	2.47	2.33	1.73	1.65	1.65	1.68
5	5.60	8.94	3.50	3.33	2.75	2.38	2.30	2.05	1.73	1.60	1.65	1.65
6	4.43	5.32	3.25	3.33	2.65	2.30	2.50	1.98	1.68	1.60	1.70	1.68
7	3.82	4.35	3.10	3.20	2.55	3.30	2.65	1.92	1.63	1.65	1.70	1.65
8	3.50	3.65	3.40	3.82	2.55	5.70	2.80	1.37	1.58	1.65	1.70	1.60
9	3.15	3.50	5.12	5.65	2.50	4.15	2.55	1.82	1.83	1.65	1.70	1.65
10	3.00	3.25	5.45	5.00	2.45	3.50	2.38	1.80	1.68	1.65	1.65	1.65
11	2.55	3.00	4.50	4.25	2.40	3.45	2.20	1.73	1.63	1.65	1.65	1.68
12	2.87	4.10	4.85	3.60	2.35	3.98	2.15	1.45	1.63	1.70	1.65	1.70
13	2.93	4.83	4.60	3.40	2.30	3.50	2.75	2.28	1.58	1.90	1.65	1.60
14	2.98	4.10	4.18	3.35	2.25	3.10	3.25	2.13	1.58	1.80	1.75	1.68
15	2.55	3.75	3.75	3.50	2.25	2.92	3.10	1.93	1.53	1.80	1.65	1.68
16	2.45	9.15	3.45	3.53	2.20	2.75	2.70	1.73	1.58	1.80	1.65	1.60
17	2.63	10.32	3.20	3.50	2.17	2.70	2.45	1.73	1.71	1.70	1.70	1.68
18	2.65	5.90	3.00	3.30	2.15	2.50	2.30	1.65	1.93	1.75	1.75	1.70
19	2.68	4.65	2.90	3.30	2.07	2.40	2.20	1.63	1.98	1.75	1.80	1.65

Mean daily gage height, in feet, of Greenbrier River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	2.52	3.90	2.75	3.15	2.10	2.30	2.10	1.73	1.96	1.75	1.80	1.60
21	2.50	3.50	2.70	3.15	2.05	2.22	2.05	1.68	1.93	1.80	1.90	1.70
22	2.68	3.40	3.38	3.30	2.05	2.12	1.80	1.65	1.90	1.80	1.85	1.80
23	2.78	3.20	11.10	3.25	2.02	2.10	1.95	1.68	1.85	1.75	1.85	1.88
24	2.75	3.20	11.90	3.15	2.00	2.10	1.90	1.68	1.80	1.75	1.80	1.88
25	2.65	3.20	6.28	3.10	2.02	2.10	1.85	1.65	1.70	1.75	1.80	1.87
26	2.60	3.16	4.62	3.90	2.10	2.25	1.80	1.65	1.68	1.75	1.78	2.00
27	2.58	3.10	4.00	6.10	2.10	2.18	1.76	1.48	1.65	1.75	1.75	2.10
28	3.38	9.15	3.55	4.90	3.30	2.35	1.75	1.45	1.65	1.70	1.75	2.07
29	6.50	.....	3.30	4.10	2.90	3.25	1.67	1.45	1.65	1.70	1.65	2.00
30	6.92	.....	3.05	3.65	2.65	4.00	1.75	1.88	1.65	1.65	1.50	2.00
31	6.50	.....	3.45	.....	2.50	.....	1.95	1.93	.....	1.70	.....	2.20

NEW RIVER AT RADFORD, VA.

New River rises in Watauga, Ashe, and Alleghany counties, N. C., and flows in a northwesterly direction into West Virginia, where, after meeting the Gauley, near Kanawha Falls, it is known as the Kanawha. The station at Radford is located at the highway bridge close to the Norfolk and Western Railway station. It was established by D. C. Humphreys August 1, 1898. The gage used was erected by the United States Weather Bureau. It consists of a vertical board graduated to feet and tenths, and is attached to the iron framework connecting the pair of iron concrete cylinders which form the first pier from the right bank. On account of the inaccessibility of the Weather Bureau gage, a wire gage was put in February 23, 1900, the datum being the same as that of the old gage. On December 1, 1903, the old wire gage was replaced by a standard chain gage which was installed by W. C. Sawyer. At this time the gage datum was lowered 3.41 feet. The length of the chain from the end of the weight to the marker is 87 feet. The observer is T. M. Brady, saddler and harness dealer. The channel is straight for several hundred feet above and below the station and has a width of 580 feet at ordinary stages, broken by five piers. At high water its width is about 1,200 feet. The bottom is of solid rock and gravel and is smooth and regular. On the left bank there is a steep, rocky bluff. The right bank is low and subject to overflow for about 100 yards, but all the water must pass under the bridge, which is about 85 feet above low water. The discharge measurements are made from the upstream side of the bridge. The initial point for soundings is on the right bank of the river 50 feet from the first pier.

Bench mark No. 1 is the bottom of the lowest horizontal brace connecting the two cylinders, the elevation being 3.88 feet above the gage datum. Bench mark No. 2 is the top of the lowest horizontal brace on the west side of the bridge 2.5 feet south of the northwest

post of the bent nearest the river on the right bank. Its elevation is 22.65 feet above the new gage datum. Bench mark No. 3 is the northwest corner of the top of the stone under the seventh post from the right bank. Its elevation is 18.54 feet above the new gage datum.

The observations at this station during 1903 have been made under the direction of E. G. Paul, district hydrographer.

Discharge measurements of New River at Radford, Va., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 21	E. C. Murphy	1.45	5,214
September 23	Paul and Sawyer	.13	2,106
November 30	W. C. Sawyer	[a] 3.21	1,212

[a] Gage datum lowered.

Mean daily gage height, in feet, of New River at Radford, Va., for 1903.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.50	0.90	6.80	3.10	1.40	1.60	1.80	1.20	1.30	−0.10	0.20	0.50
2	.60	.90	4.50	2.40	1.20	1.50	1.40	2.40	1.10	− .10	.30	[b] 3.50
3	4.70	.90	3.20	1.90	1.20	1.50	1.00	1.80	.90	− .10	.30	3.40
4	3.40	.90	2.30	2.90	1.20	1.40	.80	1.50	.70	− .10	.30	3.40
5	2.80	2.50	1.50	4.00	1.10	1.40	.80	1.30	.70	.00	.40	3.50
6	2.40	2.00	1.30	3.00	1.10	1.30	2.00	1.00	.70	.00	.80	3.50
7	1.90	1.80	1.20	3.50	1.00	2.00	1.00	.80	.60	.10	.50	3.50
8	1.60	1.60	1.20	3.20	1.00	1.90	1.30	.70	.60	1.35	.50	3.40
9	1.40	1.40	1.00	3.40	1.00	1.90	1.00	.50	.60	1.50	.40	3.40
10	1.20	1.30	1.50	3.00	1.00	1.80	1.00	.50	1.10	.80	.30	3.30
11	1.00	1.20	1.80	2.40	1.00	1.60	.80	.50	.70	.60	.20	3.10
12	.80	2.80	2.00	2.00	1.00	1.60	1.50	.40	.60	.50	.30	3.00
13	.80	2.40	1.90	1.50	.90	1.50	1.40	.40	.60	.40	.30	3.10
14	.60	1.90	1.80	2.40	.90	1.50	1.40	.80	.50	.20	.20	3.20
15	.60	1.50	1.60	2.80	.80	1.40	2.00	1.10	.50	.10	.20	3.10
16	.50	1.30	1.60	2.90	.80	1.30	1.40	1.00	.50	.00	.30	3.00
17	.50	8.50	1.40	2.00	.80	1.20	1.20	.90	3.40	.10	.30	3.00
18	.50	4.30	1.20	1.60	.70	1.00	1.00	.90	1.80	1.00	.40	3.00
19	.50	3.20	1.00	1.60	.70	.90	1.00	.70	1.20	.70	.70	2.90
20	.40	2.00	1.00	1.50	.60	.80	.80	.80	1.00	.40	.70	3.00
21	.60	1.50	.90	1.50	.60	.60	.70	.70	.80	.30	.60	3.20
22	1.40	1.30	2.00	1.40	.50	.50	.60	.60	.70	.20	.40	3.40
23	1.20	1.30	9.00	1.40	.50	.70	.50	.60	.60	.10	.30	3.70
24	1.00	1.20	9.10	1.40	.60	.60	.40	.50	.10	.10	.20	3.70
25	1.00	1.00	4.20	1.50	.60	.60	.40	.50	.10	.10	.40	3.60
26	.90	1.00	2.90	1.50	.80	.50	.40	.40	.00	.00	.30	3.60
27	.90	1.00	2.50	2.30	.90	1.40	.40	.30	.00	.00	.20	3.60
28	.90	2.40	1.80	1.90	1.00	4.30	.30	.30	.00	.00	− .10	3.40
29	1.00	.....	2.00	1.60	1.00	3.00	.30	.20	.00	.00	− .10	3.30
30	1.40	.....	7.00	1.50	1.20	2.50	.30	.30	− .10	.10	.00	3.30
31	1.20	.....	4.00	.....	1.60	.....	.60	.70	.....	.20	.....	3.80

[a] These gage heights are in error from 0.1 to 0.2 owing to stretch in the gage wire.
[b] Gage datum lowered 3.41′.

NEW RIVER NEAR OLDTOWN, VA.

This station, like those on the North and South forks of New River, was established to aid in the hydrographic investigations undertaken by the United States Geological Survey in the southern Appalachian area. It was established July 31, 1900, and is located about 2 miles west of Oldtown. Oldtown is 30 miles from the railroad at Mount Airy, N. C., and 9 miles from a branch of the Norfolk and Western Railway, and can only be reached by private conveyance.

The gaging station was located at Austin's ferry. The wire gage is fixed in an overhanging tree on the left bank, about 50 yards upstream from the ferry. The scale is so placed that the zero mark is next the bank, the distance from the index on the wire to the end of the weight being 16.1 feet. The initial point for soundings is on the right bank and the measurements of discharge are made from the ferryboat. The channel above and below the station is straight and the current swift. The right bank is high and rocky and is never submerged, but the left bank is lower, and at times floods cover it for a considerable distance.

Since the gage rod at this station is so placed that the zero mark is next to the bank the gage readings were reversed, a rise in the water surface being indicated by a decrease in the gage reading, and vice versa. This is true of all figures for gage heights for this station published in Water Supply Papers Nos. 48 and 65.

This rectification was made by subtracting all observed gage heights from 7.3 feet, this being the length of the gage, and also the gage height which corresponded to the lowest stage of the stream. Gage heights, as printed herewith, above 7.3 feet are estimated by the observer. The only exception to this rule is the height of the flood of May 22, 1901, which was determined directly by leveling. This was the greatest flood since 1878, when the river rose some 4 or 5 feet higher. Owing to the inaccessibility of this station, no measurements of the flow were made during 1902, though daily records of the stage of the surface have been maintained. The station was discontinued March 31, 1903.

The observations at this station during 1903 have been made under the direction of E. W. Myers, district hydrographer.

In 1903 the following discharge measurement was made by E. W. Myers:

February 6: Gage height, 1.70 feet; discharge, 3,533 second-feet.

Mean daily gage height, in feet, of New River near Oldtown, Va., for 1903.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	1.60	1.20	4.10	12	0.90	2.80	2.10	23	0.90	1.40	4.70
2	2.90	1.10	2.60	13	.90	2.40	2.00	24	.90	1.20	4.80
3	3.90	1.20	2.10	14	.90	1.90	1.80	25	.90	1.10	3.00
4	2.40	1.40	1.80	15	.90	1.60	1.60	26	1.00	1.10	2.40
5	1.90	3.00	1.60	16	.90	1.50	1.50	27	1.10	1.20	2.00
6	1.50	1.80	1.50	17	.90	5.40	1.50	28	1.30	2.90	1.60
7	1.30	1.50	1.50	18	.90	3.20	1.40	29	1.40	.....	5.60
8	1.10	1.90	1.60	19	.90	2.20	1.20	30	1.50	.....	3.10
9	.90	1.90	1.70	20	.90	2.10	1.20	31	1.30	.....	2.20
10	.90	1.80	1.80	21	.90	1.80	1.40				
11	.90	1.70	2.40	22	.90	1.50	1.70				

CUMBERLAND RIVER DRAINAGE BASIN.

Cumberland River rises in the eastern part of Kentucky and flows west till it meets the South Fork, which rises in northern Tennessee and flows northward. After this junction the Cumberland turns toward the southwest into Tennessee, and, after flowing through the north-central part, again enters Kentucky in Trigg County, flows across the State, and enters the Ohio River at Smithland, about 15 miles above the mouth of Tennessee River. The gaging station on this river is located at Nashville, Tenn.

CUMBERLAND RIVER AT NASHVILLE, TENN.

The gage, which belongs to the United States Engineer Corps, is at the foot of Broad street. It is in three sections, two of which are upright and one inclined. The lowest section, extending from −0.2 foot to +46 feet, is on the slope of the bank and consists of timbers embedded in the ground, bearing an iron strap, into which the markings are cut. The section extending from gage height 46 to 53 feet is fastened to a small building at the top of the bank, and consists of a timber painted white with black markings. The top section of the gage, extending from 52 feet to 55.3 feet, is on the corner of Temperance Hall, painted on the stones in white with black markings. In addition there is a vertical section reading from −1.2 feet to +2 feet. The datum of the gage corresponds to elevation 110.3 feet of the city levels. A cross, cut on the upper face of the corner stone in the southeast corner of Temperance Hall, on Broad street, near Front street, is 52 feet above the zero of the gage, and 366.6 feet above mean sea level. The highest observed water was 55.3 feet on January 22, 1882. The lowest occurred on October 15 and 16, 1878, at a gage height of −0.4 foot. The danger line is at 40 feet.

Records have been kept for a number of years by the United States Weather Bureau, from which readings previous to those here published may be obtained.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Mean daily gage height, in feet, of Cumberland River at Nashville, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	12.80	10.50	28.40	13.70	12.30	14.30	3.60	2.30	2.10	0.80	0.70	2.30
2	12.40	10.40	30.80	15.30	11.20	16.00	3.20	2.20	2.50	.80	1.40	2.10
3	15.20	10.20	34.20	16.20	10.30	17.30	3.90	2.10	2.30	.80	1.50	1.90
4	16.30	14.40	36.40	16.70	9.50	18.20	4.60	2.40	2.00	.70	1.30	1.90
5	16.60	21.40	36.90	16.40	8.80	25.80	5.00	3.20	2.00	.70	2.80	1.90
6	17.30	24.80	37.90	15.30	8.10	25.30	4.50	3.40	1.90	.80	2.80	1.80
7	17.80	28.30	38.90	14.50	7.60	22.70	3.80	4.40	1.90	1.10	2.70	1.70
8	17.60	29.90	39.80	18.70	7.00	22.00	3.40	4.90	2.10	1.40	2.40	1.70
9	16.20	30.50	40.70	26.30	6.60	20.00	3.40	5.10	2.00	1.70	2.20	1.60
10	14.40	29.00	39.20	29.20	6.20	16.80	3.60	5.40	1.90	1.70	2.00	1.60
11	12.90	25.90	38.60	32.40	6.00	14.30	3.20	5.60	1.80	1.70	1.80	1.50
12	13.60	23.60	38.40	33.90	5.50	12.80	4.00	5.60	1.70	1.50	1.60	1.40
13	13.70	21.50	37.40	34.20	5.20	11.00	5.20	5.20	1.60	1.70	1.50	1.40
14	14.10	21.70	36.00	33.60	5.10	9.80	6.10	4.30	1.60	1.70	1.50	1.40
15	15.60	23.40	33.80	31.70	5.00	8.60	4.50	3.80	1.50	1.60	1.40	1.40
16	17.00	25.90	30.90	31.10	4.80	7.40	4.40	3.90	1.50	1.60	1.40	1.40
17	16.60	29.50	27.10	32.00	4.50	6.40	4.00	4.50	1.40	1.60	2.30	1.40
18	14.80	31.50	23.90	32.80	4.30	5.60	3.80	5.60	1.40	1.50	6.00	1.40
19	13.80	34.80	21.60	32.60	4.00	5.00	3.50	5.10	1.30	1.40	5.50	1.40
20	10.90	36.40	19.30	30.50	3.80	4.60	5.50	4.40	1.30	1.40	6.30	6.70
21	9.40	37.50	17.40	26.80	3.80	4.30	4.60	3.90	1.20	1.30	6.20	16.40
22	8.80	37.20	16.30	23.70	3.60	3.90	4.70	3.80	1.20	1.30	5.70	15.50
23	7.60	34.70	16.10	21.70	3.60	3.80	4.30	3.70	1.10	1.20	5.90	15.90
24	7.50	29.00	15.90	21.00	3.20	3.90	3.90	3.40	1.00	1.00	5.30	16.50
25	6.00	22.10	16.30	20.20	3.10	3.70	4.00	3.30	1.00	1.00	4.50	16.10
26	7.00	18.20	17.30	18.90	3.00	3.60	3.80	3.30	.90	.90	4.40	16.40
27	7.20	16.40	19.60	17.30	2.90	3.70	3.40	3.00	.90	.80	3.50	15.30
28	7.70	21.20	20.50	15.70	2.90	4.00	3.00	2.80	.80	.80	3.00	14.30
29	9.70	.....	19.20	14.30	3.80	4.50	2.90	2.50	.80	.80	2.70	14.10
30	10.40	.....	16.60	13.30	8.30	3.70	2.60	2.50	.80	.90	2.40	14.80
31	10.60	.....	14.30	.....	11.50	.....	2.40	2.20	.....	.80	.....	13.80

MISCELLANEOUS MEASUREMENTS IN CUMBERLAND RIVER DRAINAGE BASIN DURING 1903.

Cumberland River was measured 500 feet above wagon bridge near Williamsburg, Tenn. The bench mark is top of upstream end of third crossbeam from left-bank end of main center span of bridge. On October 23 the water surface was 38.18 feet below the bench mark and the discharge was 44 second-feet.

TENNESSEE RIVER DRAINAGE BASIN.

Tennessee River is formed by the junction of the French Broad and the Holston about 4 miles above Knoxville, Tenn. It flows southwest, crossing into Alabama about 40 miles below Chattanooga, Tenn., and, after crossing the northern part of Alabama, again enters Tennessee in Harding County. It then flows north, crossing Tennessee and Ken-

tucky, and enters the Ohio River at Paducah, about 40 miles above Cairo. Its principal tributary on the north is Clinch River, which enters it near Kingston, Roan County, Tenn. The principal tributaries on the south are Hiwassee and Little Tennessee rivers. Hiwassee rises in the northern part of Georgia and flows into the Tennessee about 30 miles above Chattanooga. Its principal tributaries are the Okoee and the Nottely. Little Tennessee River rises in the northern part of Georgia, flows across the southwestern part of North Carolina, and enters the Tennessee near Loudon, Tenn. Its principal tributary is the Tuckasegee. French Broad River rises in the western part of North Carolina. Its principal tributaries are the Pigeon and the Nolichucky. Holston River rises in the western part of Virginia. Its principal tributary is Watauga River, into which stream Roan Creek enters. During 1903 the United States Geological Survey maintained the following stations in this basin under the supervision of M. R. Hall, district hydrographer for this section: On the Tennessee at Chattanooga, Tenn.; on the Toccoa (Okoee) near Blue Ridge, Ga.; on the Okoee at McCays, Tenn.; on the Hiwassee at Reliance, Tenn.; on the Nottely at Ranger, N. C.; on the Hiwassee at Murphy, N. C.; on the Little Tennessee at Judson, N. C.; on the Tuckasegee at Bryson, N. C.; on the Tennessee at Knoxville, Tenn.; on the French Broad at Oldtown, near Newport, Tenn.; on the Pigeon at Newport, Tenn.; on Nolichucky River near Greenville, Tenn.; on the Holston (S. F.) at Bluff City, Tenn.; on the Watauga near Elizabethton, Tenn.

TENNESSEE RIVER AT CHATTANOOGA, TENN.

This station was established in 1879, at the foot of Lookout street, just below Chattanooga Island, by the Signal Corps of the United States Army; but since July 1, 1891, it has been in charge of the Weather Bureau. During the year 1900 a new gage was established. It is a vertical metal scale bolted to the south side of the third stone pier from the south end of the Hamilton County highway bridge. During the present year the self-registering gage invented by Professor Fulton, of Tennessee University, has been in use at this station. The gage is connected by wire with the Weather Bureau office, and a continuous electrical record of river height is made in the same manner as the record of wind, sunshine, etc. Gage heights are furnished to the Geological Survey through L. M. Pindell.

Discharge measurements are made from the steel highway bridge in six spans and an approach about 1,000 feet long on the right bank. The floor of the bridge is about 125 feet above low water. The initial point for soundings is the outside corner of the iron post of the downstream hand rail on the left bank. The channel is curved for 3,000 feet above and 2,000 feet below the station. The right bank is high and overflows at flood stages, but all water passes under the bridge or its approach. The left bank is a high, rocky bluff, and will not

overflow. The bed is composed of loose rock, sand, and gravel, and is fairly constant. The bench mark is the top of the water table on the southeast corner of the post-office on Eleventh street. Its elevation is 74.4 feet above the zero of the gage, and 705 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tennessee River at Chattanooga, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 26	O. P. Hall	28.85	190,279
July 21	M. R. Hall	3.85	20,936
September 5	J. M. Giles	1.60	10,472
October 21	M. R. Hall	1.10	8,063

Mean daily gage height, in feet, of Tennessee River at Chattanooga, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	4.80	26.50	17.40	9.00	6.50	4.10	2.80	1.70	0.60	0.80	1.10
2	4.50	4.90	31.00	16.60	8.30	8.20	3.80	2.60	1.60	.60	.90	1.10
3	5.30	5.10	29.20	14.80	7.80	11.60	3.70	2.90	1.40	.60	1.10	1.10
4	6.10	7.60	23.60	13.00	7.30	11.50	3.60	3.80	1.40	.60	1.20	1.00
5	6.90	15.40	16.50	12.30	7.00	10.10	3.60	3.80	1.30	.60	1.80	1.00
6	6.80	19.60	13.10	12.40	6.70	9.30	3.80	4.20	1.30	.60	1.80	.90
7	8.20	17.50	12.30	11.90	6.60	9.80	3.90	4.90	1.30	.60	1.50	1.00
8	7.60	18.00	14.60	15.50	6.30	11.20	3.80	4.20	1.30	.80	1.40	.90
9	6.70	17.20	20.70	24.50	6.00	10.50	4.00	3.60	1.30	1.00	1.30	1.00
10	6.00	15.30	24.40	30.30	5.80	9.00	4.00	3.00	1.20	1.50	1.30	.90
11	5.50	14.40	23.90	31.80	5.60	8.70	3.90	2.60	1.20	1.40	1.30	.90
12	6.20	16.00	21.00	28.00	5.40	7.80	3.80	2.70	1.10	1.30	1.30	.90
13	7.10	16.30	18.30	19.70	5.20	8.00	4.10	3.30	1.10	1.20	1.30	1.00
14	7.20	14.80	16.20	17.50	5.00	7.10	5.70	2.90	1.10	1.20	1.30	.90
15	6.50	13.60	14.90	20.40	4.90	6.30	5.50	3.20	1.20	1.00	1.20	.90
16	6.00	12.30	13.60	21.90	4.80	5.60	5.40	3.80	1.10	.90	1.20	1.00
17	5.80	18.40	11.90	21.20	4.70	5.10	5.60	4.10	1.00	1.00	1.50	1.20
18	5.40	25.90	10.70	18.80	4.60	4.70	5.10	3.80	1.20	1.00	3.60	1.10
19	5.10	29.30	9.80	16.10	4.50	4.40	4.70	3.40	1.30	1.00	6.10	1.00
20	4.80	29.00	9.00	14.20	4.30	4.30	4.10	3.80	1.30	.90	5.80	1.40
21	4.50	24.40	9.00	13.20	4.20	4.30	3.80	3.30	1.10	.90	4.60	3.00
22	4.40	15.40	9.00	13.00	4.10	4.30	4.00	3.00	1.20	.90	3.80	4.70
23	4.20	11.30	10.00	13.00	4.00	4.30	3.60	2.90	1.20	.90	3.10	4.40
24	4.00	9.90	16.70	11.80	4.00	4.30	3.20	2.50	1.10	.80	2.50	3.70
25	4.00	8.80	25.80	10.80	3.80	4.20	2.90	2.20	1.00	.80	2.10	3.70
26	4.20	8.00	28.80	10.10	3.80	4.10	2.70	2.00	1.00	.70	1.80	3.40
27	4.30	7.50	27.30	9.60	3.60	4.10	2.60	1.80	.80	.70	1.60	3.10
28	4.40	12.70	20.10	9.20	3.50	4.50	2.40	1.70	.70	.60	1.50	3.70
29	4.50	.....	13.80	9.20	3.50	4.70	2.30	1.60	.70	.60	1.30	3.80
30	4.70	.....	13.10	9.60	3.80	4.50	2.30	1.60	.60	.60	1.20	3.80
31	4.80	.....	16.00	.....	4.70	.....	2.20	1.80	.....	.70	.....	3.70

Rating table for Tennessee River at Chattanooga, Tenn., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	6,100	2.3	13,240	5.0	27,220	14.0	85,200
.7	6,490	2.4	13,700	5.2	28,400	15.0	91,700
.8	6,880	2.5	14,160	5.4	29,600	16.0	98,200
.9	7,280	2.6	14,620	5.6	30,820	17.0	104,700
1.0	7,680	2.7	15,090	5.8	32,050	18.0	111,200
1.1	8,080	2.8	15,560	6.0	33,290	19.0	117,700
1.2	8,490	2.9	16,040	6.5	36,460	20.0	124,200
1.3	8,900	3.0	16,520	7.0	39,700	21.0	130,700
1.4	9,320	3.2	17,500	7.5	42,950	22.0	137,200
1.5	9,740	3.4	18,500	8.0	46,200	23.0	143,700
1.6	10,160	3.6	19,520	8.5	49,450	24.0	150,200
1.7	10,590	3.8	20,560	9.0	52,700	25.0	156,700
1.8	11,020	4.0	21,620	9.5	55,950	26.0	163,200
1.9	11,460	4.2	22,700	10.0	59,200	27.0	169,700
2.0	11,900	4.4	23,800	11.0	65,700	28.0	176,200
2.1	12,340	4.6	24,920	12.0	72,200	29.0	182,700
2.2	12,790	4.8	26,060	13.0	78,700	30.0	189,200

Above 6.60 feet gage height, table is same as 1902.

Estimated monthly discharge of Tennessee River at Chattanooga, Tenn., for 1903.

[Drainage area, 21,418 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	47,500	21,620	30,435	1.42	1.64
February	184,650	26,060	90,229	4.21	4.38
March	195,700	52,700	109,690	5.12	5.90
April	200,900	54,000	99,890	4.66	5.20
May	52,700	19,010	29,098	1.36	1.57
June	69,600	22,160	38,661	1.81	2.02
July	31,430	12,790	20,855	.97	1.12
August	26,640	10,160	16,818	.79	.91
September	10,590	6,100	8,337	.39	.44
October	9,740	6,100	7,124	.33	.38
November	37,100	6,880	12,597	.59	.66
December	25,490	7,280	12,176	.57	.66
The year	200,900	6,100	39,659	1.85	24.88

TOCCOA (OKOEE) RIVER NEAR BLUERIDGE, GA.

This stream, called Toccoa River in Georgia and Okoee River in Tennessee, has its source on the northern slopes of the Blue Ridge Mountains in Georgia and flows northwest into Hiwassee River. The area is covered with a fine growth of oak, hickory, and other hard woods. The station, established by B. M. Hall on November 25, 1898, is located at the Morganton bridge, about 4 miles east of the town of Blueridge, Ga. The gage is a 14-foot rod, in two 7-foot sections, nailed to a tree on the right bank just below the bridge. It is graduated to feet and tenths and is set to conform to bench marks which were established October 15, 1896, and October 26, 1898. The measurements during 1896 were made at the railroad bridge about 3 miles below, but are referred to the present gage by comparison of the bench marks at the two bridges. The bench mark at Morganton bridge is on the top of the bridge floor, on the downstream side, 50 feet from the initial point, and is 18 feet above the zero of the gage. The bridge was a wooden, queen-post, open bridge, in three spans, with a total length between abutments of 153 feet, but it has been remodeled and changed into a closed bridge, not suitable for use in making discharge measurements at such an irregular section. Measurements are now made at a ferry about 2½ miles below, but the gage at the bridge is still maintained. The observer was W. E. Rogers, a farmer living about a quarter of a mile east of the gage. The station was discontinued March 31, 1903.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Mean daily gage height, in feet, of Toccoa River near Blueridge, Ga., for 1903.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	3.00	3.00	6.00	12	2.80	3.80	4.00	23	3.00	3.80	4.00
2	3.00	3.00	5.00	13	2.80	3.60	4.00	24	3.00	3.80	4.00
3	3.50	4.00	5.00	14	2.80	3.60	4.00	25	3.00	3.80	4.00
4	3.00	5.00	5.00	15	2.80	4.00	4.00	26	3.00	3.60	4.00
5	3.00	4.00	4.80	16	2.80	4.00	4.00	27	3.00	3.60	3.80
6	2.80	4.00	4.80	17	2.80	4.00	4.00	28	3.00	10.00	3.80
7	2.80	4.00	4.60	18	2.80	4.00	4.00	29	3.00	.....	4.00
8	2.80	3.00	4.50	19	2.80	3.80	4.00	30	3.00	.....	7.00
9	2.80	4.00	4.50	20	3.00	3.80	4.00	31	3.00	.....	6.00
10	2.80	4.00	4.20	21	3.00	3.80	4.00				
11	2.80	3.80	4.20	22	3.00	3.80	4.00				

Rating table for Toccoa (Okoee) River near Blueridge, Ga., from January 1, 1902, to March 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.2	270	3.6	1,162	5.0	2,660	6.8	4,586
2.3	312	3.7	1,269	5.1	2,767	7.0	4,800
2.4	355	3.8	1,376	5.2	2,874	7.2	5,014
2.5	400	3.9	1,483	5.3	2,981	7.4	5,228
2.6	447	4.0	1,590	5.4	3,088	7.6	5,442
2.7	497	4.1	1,697	5.5	3,195	7.8	5,656
2.8	550	4.2	1,804	5.6	3,302	8.0	5,870
2.9	606	4.3	1,911	5.7	3,409	9.0	6,940
3.0	666	4.4	2,018	5.8	3,516	10.0	8,010
3.1	732	4.5	2,125	5.9	3,623	11.0	9,080
3.2	804	4.6	2,232	6.0	3,730	12.0	10,150
3.3	883	4.7	2,339	6.2	3,944	13.0	11,220
3.4	969	4.8	2,446	6.4	4,158	14.0	12,290
3.5	1,062	4.9	2,553	6.6	4,372		

Estimated monthly discharge of Toccoa River near Blueridge, Ga., for 1903.

[Drainage area, 231 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,062	550	626	2.71	3.12
February	8,010	666	1,629	7.05	7.24
March	4,800	1,376	2,046	8.86	10.21

OKOEE RIVER AT M'CAYS, TENN.

This station was established March 21, 1903, by O. P. Hall, and was permanently equipped by M. R. Hall, on May 13, 1903. It is located at a suspension footbridge just below McCays's ferry at McCays, Tenn., near the Georgia-Tennessee boundary and one-half mile below the railroad bridge of the Atlanta, Knoxville and Northern Railroad. The gage is in two sections, the inclined section reading from −0.3 to 8.5 feet, and consists of double 2 by 6 inch timbers, spiked and bolted together, set in a trench and held in place by 2 by 6 inch posts driven into the ground and bolted or spiked to the gage.

The vertical section, reading from 8 to 16 feet, is attached to the bridge posts on the right bank. Discharge measurements are made from the suspension footbridge, consisting of four wire cables and a plank footway. Its span is about 230 feet and it is 23 feet above the water surface at the end supports and 17 feet above the water surface at the middle. The initial point for soundings is the center of the high bent supporting the bridge on the left bank. The channel is practically straight for about 800 feet above and below the station. The right bank will overflow at about 14 feet gage height for about 500 feet; the left bank will overflow at gage height 12 to 20 feet for about 400 feet. The water is confined to one channel and the bed is probably constant. The current is good and the section is excellent.

Bench mark No. 1 is a cut on a walnut tree on the downstream side of the road, about 50 feet from the left-bank landing of McCays's ferry; its elevation is 12.59 feet above the zero of the gage. Bench mark No. 2 is the head of a large nail in the center of a post at the right-bank end of the footbridge, on the downstream side; its elevation is 16.10 feet above the zero of the gage. This post is an anchor post for the cable of the suspension bridge and may be pulled out of place. Bench mark No. 3 is a copper plug set in solid rock at the outer edge of the side ditch of the railroad bed, about 800 feet west of the railroad station at McCays. It is 11 feet north of the center of the track and is slightly higher than the railroad. Its elevation is 20.98 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Okoee River at McCays, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 21	O. P. Hall	3.42	2,063
May 12	M. R. Hall	1.87	992
May 14	do	1.86	990
July 24	O. P. Hall	1.37	727
August 21	do	1.17	584
October 8	do	1.22	624
October 9	do	.85	429
December 7	do	.53	307

Mean daily gage height, in feet, of Okoee River at McCays, Tenn., 1903.

Day.	Mar.	Apr	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.70	2.30	2.70	1.60	1.40	0.80	0.60	0.70	0.60
2	.....	3.50	2.30	3.90	1.60	1.30	.80	.60	.70	.60
3	.....	3.30	2.20	2.80	1.60	1.00	.90	.60	.90	.50
4	.....	3.60	2.20	2.70	1.70	1.20	.90	.60	.90	.50
5	.....	3.10	2.10	4.30	1.50	1.40	.90	.60	1.20	.60
6	.....	3.10	2.10	4.10	1.50	1.30	.80	.60	.90	.60
7	.....	3.00	2.10	3.10	1.60	1.20	.80	.60	.80	.50
8	.....	4.40	2.00	2.60	1.60	1.10	.80	1.50	.70	.50
9	.....	3.20	2.00	2.40	1.50	1.10	.90	.90	.70	.50
10	.....	3.10	2.00	2.30	1.60	1.10	.90	.70	.60	.60
11	.....	2.90	2.00	2.80	2.30	1.60	.80	.70	.60	.60
12	.....	2.80	1.90	2.30	1.80	1.10	.80	.70	.90	.50
13	.....	3.30	1.90	2.20	6.30	1.10	.70	.60	.70	.70
14	.....	3.10	1.90	2.10	2.60	1.00	.70	.60	.70	.80
15	.....	3.50	1.90	2.00	1.90	1.80	1.00	.60	.70	.60
16	.....	3.20	1.80	2.00	1.70	1.90	1.30	.60	.70	.50
17	.....	3.10	1.70	1.80	1.80	1.30	1.00	.90	1.20	.50
18	.....	3.10	1.70	1.80	1.60	1.90	.90	.90	1.20	.50
19	.....	2.90	1.70	1.70	1.50	1.20	.80	.70	.80	.50
20	.....	3.10	1.70	1.70	1.50	2.40	.80	.70	.80	.90
21	.....	2.90	1.70	1.70	1.40	1.20	.80	.60	.70	.90
22	4.30	2.70	1.60	1.70	1.40	1.10	.80	.60	.70	.80
23	5.00	2.60	1.60	1.70	1.40	1.10	.70	.60	.70	.60
24	4.60	2.50	1.60	1.60	1.40	1.00	.70	.60	.70	.60
25	3.70	2.50	1.50	1.60	1.30	1.00	.70	.60	.60	.60
26	3.50	2.60	1.50	1.80	1.30	1.00	.70	.60	.60	.70
27	3.30	2.50	1.50	2.20	1.30	.90	.70	.60	.60	.70
28	3.20	2.40	1.50	2.60	1.30	.90	.70	.60	.60	.60
29	3.40	2.30	1.50	1.80	1.20	.90	.70	.60	.60	.70
30	6.40	2.30	1.80	1.60	1.40	.90	.60	.60	.60	.70
31	4.30	.....	1.90	.....	1.70	.90	.....	.70	.....	.60

Rating table for Okoee River at McCays, Tenn., from March 20 to December 31, 1903.

Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	297	1.7	887	2.9	1,690	4.1	2,575
.6	332	1.8	950	3.0	1,760	4.2	2,650
.7	370	1.9	1,015	3.1	1,830	4.3	2,725
.8	411	2.0	1,080	3.2	1,900	4.4	2,800
.9	455	2.1	1,145	3.3	1,975	4.5	2,875
1.0	502	2.2	1,210	3.4	2,050	4.6	2,950
1.1	551	2.3	1,275	3.5	2,125	4.7	3,025
1.2	602	2.4	1,340	3.6	2,200	4.8	3,100
1.3	655	2.5	1,410	3.7	2,275	4.9	3,175
1.4	710	2.6	1,480	3.8	2,350	5.0	3,250
1.5	767	2.7	1,550	3.9	2,425		
1.6	826	2.8	1,620	4.0	2,500		

Table well determined to 3.50 feet gage height. Curve reached tangent at 5 feet. Differences thereafter, 80 per tenth.

Estimated monthly discharge of Okoee River at McCays, Tenn., for 1903.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March 22–31	4,370	1,900	2,634
April	2,800	1,275	1,772
May	1,275	767	982
June	2,725	826	1,306
July	4,290	602	936
August	1,340	455	642
September	655	332	419
October	767	332	365
November	602	332	398
December	455	297	340

HIWASSEE RIVER AT RELIANCE, TENN.

This station was established August 17, 1900, by O. P. Hall. It is located at the Atlanta, Knoxville and Northern Railroad bridge, near the ferry landing. The gage consists of a vertical rod, reading from zero to 10 feet, fastened to an oak tree on the right bank, 150 feet above the railroad bridge and 40 feet below the ferry landing, and a 5-foot section, reading from 10 to 15 feet, attached to a sycamore tree on the downstream side of the road leading to the ferry, about 400 feet from the river. The gage is read once each day by C. V. Higdon. Discharge measurements are made from the railroad bridge and from the wooden trestles on both banks. The railroad track is about 34 feet above low water. The initial point for soundings is the center of the heavy bolt or bridge pin, about 1 foot from the end of the bridge on the right bank, downstream side. This point is also at the center of the pier on the right bank. Above the station the channel makes a sharp bend to the east for a distance of 800 feet. Below the station the channel makes a sharp bend to the west for about 1,000 feet. At ordinary stages the river is about 350 feet wide at this point, and the section is a fairly good one. The water is held back by a ledge of rock below and is rather sluggish at low stages. Discharge measurements at low stages can be made at a ferry near Wetmore, 6 miles below. Both banks overflow, but all water passes beneath the bridge and its approaches.

Bench mark No. 1 is a cut in a hickory tree on the right bank of the river, about 75 feet upstream from the bridge. Its elevation is 5.82 feet above the zero of the gage. Bench mark No. 2 is the top of the downstream iron girder under the cross-ties at a point about 40

feet from the end of the bridge on the right bank. Its elevation is 23.90 feet above the zero of the gage. Bench mark No. 3 is the top of the capstone of the right-bank pier on the upstream side of the bridge. Its elevation is 19.26 feet above the zero of the gage. Bench mark No. 4 is a copper plug set in a stone post flush with the surface of the ground at the south end of C. V. Higdon's house, under the south window. This house stands on the right bank, about 50 feet up from the foot of the hill, 600 feet north of the right-bank end of the bridge and opposite a point on the river about 300 feet above the bridge. Its elevation is 27.16 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Hiwassee River at Reliance, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 23	O. P. Hall	7.60	24,527
May 15	M. R. Hall	1.90	2,335
July 25	O. P. Hall	1.40	1,440
August 22	do	1.28	1,155
October 7	do	.92	615
December 8	do	.98	663

Mean daily gage height, in feet, of Hiwassee River at Reliance, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	1.60	6.70	3.60	2.30	2.50	1.70	1.60	1.10	0.90	1.10	1.00
2	1.70	1.60	4.00	3.20	2.20	3.40	1.60	2.10	1.10	.90	1.00	1.00
3	2.30	1.70	3.40	3.10	2.20	2.50	1.60	1.70	1.10	.90	1.10	1.00
4	3.30	2.90	3.00	3.40	2.20	2.30	1.80	1.60	1.10	.90	1.00	1.00
5	2.10	4.00	2.80	3.00	2.10	2.70	1.60	1.60	1.10	.90	1.20	1.00
6	2.00	2.80	3.10	2.90	2.10	3.60	1.60	1.60	1.10	.90	1.30	1.00
7	1.90	2.60	2.90	2.70	2.10	2.80	1.60	1.60	1.00	.90	1.20	1.00
8	1.80	4.30	[a]4.30	4.70	2.00	2.40	1.70	1.50	1.00	1.20	1.10	1.00
9	1.70	3.50	4.40	3.90	2.00	2.20	1.80	1.40	1.10	1.60	1.10	1.00
10	1.60	2.90	4.00	3.10	2.00	3.40	1.70	1.40	1.20	1.10	1.00	1.00
11	1.70	3.40	4.00	2.90	1.90	2.60	1.80	1.30	1.10	1.00	1.00	1.00
12	2.70	4.70	4.70	2.80	1.90	2.30	1.70	1.40	1.10	1.00	1.20	1.00
13	2.00	3.30	3.70	3.20	1.90	2.10	2.80	1.30	1.00	1.00	1.30	1.00
14	1.90	2.80	3.40	5.20	1.90	2.00	3.00	1.40	1.00	1.00	1.10	1.10
15	1.80	2.60	3.10	4.00	1.90	1.90	2.20	1.30	1.00	1.90	1.10	1.20
16	1.70	2.70	2.90	3.50	1.90	1.80	1.90	1.50	1.30	1.00	1.10	1.10
17	1.70	7.70	2.80	3.00	1.80	1.80	2.00	1.60	1.50	1.00	1.10	1.00
18	1.70	4.10	2.60	2.80	1.80	1.70	1.90	1.50	1.20	1.10	2.10	1.00
19	1.60	3.30	2.50	2.90	1.80	1.70	1.70	1.40	1.10	1.00	1.50	.90

[a] Mean.

Mean daily gage height, in feet, of Hiwassee River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	1.50	2.90	2.50	2.90	1.70	1.70	1.60	1.30	1.10	1.00	1.20	1.20
21	1.50	2.70	2.60	2.90	1.70	1.70	1.60	1.50	1.00	1.10	1.20	1.50
22	1.50	2.50	2.90	2.80	1.80	1.70	1.50	1.30	1.00	1.00	1.10	1.40
23	1.50	2.40	8.10	2.60	1.70	1.80	1.50	1.20	1.00	1.00	1.10	1.20
24	1.50	2.20	6.00	2.50	1.70	1.60	1.50	1.30	1.00	.90	1.10	1.10
25	1.50	2.20	4.10	2.50	1.60	1.60	1.40	1.20	1.00	.90	1.10	1.10
26	1.50	2.10	3.50	2.60	1.60	1.90	1.40	1.20	1.00	.90	1.10	1.20
27	1.50	2.00	3.20	2.50	1.60	2.20	1.40	1.10	1.00	.90	1.00	1.50
28	1.60	9.30	3.00	2.30	1.60	2.00	1.30	1.10	1.00	.90	1.00	1.30
29	1.60	.....	2.90	2.30	1.70	1.90	1.40	1.10	.90	.90	1.00	1.20
30	1.70	.....	5.00	2.20	1.80	1.80	1.50	1.20	.90	1.00	1.00	1.10
31	1.60	.....	4.60	.....	2.50	.....	1.80	1.10	.....	1.10	.....	1.10

Rating table for Hiwassee River at Reliance, Tenn., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet*	*Feet.*	*Second-feet.*
0.9	590	3.1	5,790	5.3	14,890	7.5	24,350
1.0	735	3.2	6,140	5.4	15,320	7.6	24,780
1.1	885	3.3	6,500	5.5	15,750	7.7	25,210
1.2	1,040	3.4	6,870	5.6	16,180	7.8	25,640
1.3	1,200	3.5	7,250	5.7	16,610	7.9	26,070
1.4	1,370	3.6	7,640	5.8	17,040	8.0	26,500
1.5	1,550	3.7	8,040	5.9	17,470	8.1	26,930
1.6	1,740	3.8	8,450	6.0	17,900	8.2	27,360
1.7	1,940	3.9	8,870	6.1	18,330	8.3	27,790
1.8	2,150	4.0	9,300	6.2	18,760	8.4	28,220
1.9	2,370	4.1	9,730	6.3	19,190	8.5	28,650
2.0	2,600	4.2	10,160	6.4	19,620	8.6	29,080
2.1	2,840	4.3	10,590	6.5	20,050	8.7	29,510
2.2	3,090	4.4	11,020	6.6	20,480	8.8	29,940
2.3	3,350	4.5	11,450	6.7	20,910	8.9	30,370
2.4	3,620	4.6	11,880	6.8	21,340	9.0	30,800
2.5	3,900	4.7	12,310	6.9	21,770	9.1	31,230
2.6	4,190	4.8	12,740	7.0	22,200	9.2	31,660
2.7	4,490	4.9	13,170	7.1	22,630	9.3	32,090
2.8	4,800	5.0	13,600	7.2	23,060		
2.9	5,120	5.1	14,030	7.3	23,490		
3.0	5,450	5.2	14,460	7.4	23,920		

Estimated monthly discharge of Hiwassee River at Reliance, Tenn., for 1903.

[Drainage area, 1,180 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	6,500	1,550	2,202	1.87	2.16
February	32,090	1,740	6,901	5.85	6.09
March	26,930	3,900	8,603	7.29	8.40
April	14,460	3,090	5,861	4.97	5.55
May	3,900	1,740	2,402	2.04	2.35
June	7,640	1,740	3,203	2.72	3.03
July	5,450	1,200	2,066	1.75	2.02
August	2,840	885	1,393	1.18	1.36
September	1,550	590	843	.71	.79
October	2,370	590	789	.67	.77
November	2,840	735	979	.83	.93
December	1,550	590	893	.76	.88
The year	32,090	590	3,011	2.55	34.33

NOTTELY RIVER AT RANGER, N. C.

This station was established February 16, 1901, by O. P. Hall. It is located at the wooden wagon bridge one-half mile from the railroad station at Ranger, N. C., and one-fourth mile below the Atlanta, Knoxville and Northern Railroad bridge. The vertical gage is a 1-inch by 3-inch pine board in two sections, each 8 feet long, fastened to the left-hand side of the first wooden pier from the right bank. The gage is read once each day by A. D. Kilpatrick. Discharge measurements are made from the wagon bridge, a wooden structure of three spans supported by two wooden piers and two stone abutments; the center span is 55 feet long and the end spans are each 36 feet long. The floor of the bridge is about 20 feet above low water. The initial point for soundings is the inside face of the stone abutment on the right bank. The bridge is at a flat bend in the river, the channel curving slightly above and below the station for 600 feet. The right bank is high, rocky, and is somewhat wooded, and will overflow around the end of the bridge for about 50 feet only. The left bank is low and will overflow for a distance of 700 feet at a gage height of from 15 to 18 feet. The bed of the stream is of gravel and sand and probably shifts considerably. The current is somewhat broken and irregular, caused mostly by the piers. There is a moderate velocity and a depth of from 2 to 5 feet at low stages.

Bench mark No. 1 consists of the heads of large wire nails driven in the top of the downstream end of the wooden cap on the left bent of the wooden pier nearest the right bank of the river. Its elevation is 20.05 feet above the zero of the gage. Bench mark No. 2 is a cut on

a maple tree 18 inches in diameter, 25 feet from the upstream side of the bridge on the right bank, 25 feet from the edge of the water. Its elevation is 15 feet above the zero of the gage. Bench mark No. 3 is a cut on a red oak tree about 15 inches in diameter on the left bank of the river, 35 feet from the end of the bridge near the downstream side of the road. Its elevation is 17.27 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Nottely River at Ranger, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 19	O. P. Hall	4.75	833
May 15	M. R. Hall	3.95	551
July 30	O. P. Hall	3.42	372
August 28	do	2.88	267
October 2	do	2.62	183
December 5	do	2.68	204

Mean daily gage height, in feet, of Nottely River at Ranger, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	3.20	8.80	6.40	4.20	6.00	3.80	7.00	2.80	2.60	2.70	2.50
2	3.20	3.50	6.30	6.10	4.40	7.00	3.70	4.40	2.80	2.50	2.70	2.50
3	3.00	3.60	5.80	5.70	4.30	6.00	3.60	3.70	2.70	2.50	2.80	2.50
4	4.00	9.60	5.40	5.80	4.20	6.40	3.90	3.60	2.70	2.50	2.90	2.50
5	3.80	6.00	5.00	5.30	4.20	7.40	3.60	3.50	2.70	2.60	2.90	2.60
6	3.70	4.80	4.90	5.20	4.10	7.00	3.00	3.40	2.90	2.60	2.90	2.60
7	3.70	6.00	5.00	5.10	4.00	7.50	3.70	3.30	2.80	2.60	2.90	2.60
8	3.60	7.60	5.20	5.00	4.00	5.00	3.70	3.20	2.80	4.00	2.90	2.50
9	3.60	5.40	6.70	7.00	4.00	5.00	3.80	3.00	3.20	2.80	2.80	2.50
10	3.80	4.90	6.20	6.50	4.90	4.90	4.00	3.10	2.90	2.70	2.80	2.50
11	3.80	7.60	11.00	5.80	3.90	5.20	3.90	3.40	2.80	2.70	2.70	2.50
12	4.80	7.00	7.60	5.00	3.90	5.20	5.00	3.30	2.80	2.70	3.00	2.50
13	3.80	5.40	6.20	8.60	3.90	5.00	5.80	3.20	2.70	2.60	2.80	2.50
14	3.80	5.00	5.00	8.00	3.90	4.00	5.00	4.00	2.70	2.60	2.70	2.50
15	3.70	4.70	5.40	6.60	3.90	4.00	4.00	4.00	2.70	2.80	2.60	2.50
16	3.60	4.70	5.10	5.80	3.90	4.00	3.90	3.70	2.70	2.80	2.60	2.50
17	3.50	8.00	5.10	5.70	3.80	3.80	4.40	3.30	4.00	2.90	2.80	2.60
18	3.60	5.60	5.00	5.50	3.80	3.80	3.70	3.40	3.20	2.80	4.00	2.60
19	3.50	5.20	4.90	5.40	3.80	3.80	3.60	3.40	2.90	2.70	3.00	2.70
20	3.40	5.00	4.70	5.20	3.80	3.70	4.70	3.30	2.80	2.70	2.80	3.50
21	3.40	4.70	7.00	5.00	4.00	3.70	4.00	3.00	2.90	2.70	2.80	3.40
22	3.30	4.70	8.00	5.20	3.70	3.60	3.50	3.00	2.80	2.70	2.80	3.40
23	3.30	4.60	14.80	4.80	3.50	3.50	3.40	3.20	2.80	2.60	2.70	3.80
24	3.30	4.40	8.00	4.70	3.50	3.50	3.30	3.00	2.70	2.60	2.70	3.70
25	3.40	4.40	6.20	4.60	3.60	3.50	3.00	3.00	2.70	2.60	2.70	3.60
26	3.40	4.30	6.10	4.70	3.60	5.00	3.10	2.90	2.70	2.60	2.60	3.50
27	3.30	4.50	5.60	4.70	3.60	5.00	3.10	2.90	2.70	2.60	2.60	3.40
28	3.40	17.50	5.20	4.60	3.70	4.70	3.10	2.90	2.70	2.50	2.60	3.20
29	3.60	.....	5.00	4.50	3.90	4.00	3.00	2.90	2.60	2.50	2.60	3.10
30	3.70	.....	6.40	4.30	5.50	3.80	3.00	2.90	2.60	2.70	2.50	3.00
31	3.60	.....	7.70	.....	5.70	.....	4.00	2.80	.....	2.70	.....	2.80

Rating table for Nottely River at Ranger, N. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.4	155	5.2	920	8.0	1,760	12.0	2,960
2.6	190	5.4	980	8.2	1,820	12.5	3,110
2.8	229	5.6	1,040	8.4	1,880	13.0	3,260
3.0	272	5.8	1,100	8.6	1,940	13.5	3,410
3.2	322	6.0	1,160	8.8	2,000	14.0	3,560
3.4	380	6.2	1,220	9.0	2,060	14.5	3,710
3.6	440	6.4	1,280	9.2	2,120	15.0	3,860
3.8	500	6.6	1,340	9.4	2,180	15.5	4,010
4.0	560	6.8	1,400	9.6	2,240	16.0	4,160
4.2	620	7.0	1,460	9.8	2,300	17.0	4,460
4.4	680	7.2	1,520	10.0	2,360	18.0	4,760
4.6	740	7.4	1,580	10.5	2,510	19.0	5,060
4.8	800	7.6	1,640	11.0	2,660	20.0	5,360
5.0	860	7.8	1,700	11.5	2,910	21.0	5,660

Estimated monthly discharge of Nottely River at Ranger, N. C., for 1903.

[Drainage area, 272 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	800	272	433	1.59	1.83
February	4,610	322	1,095	4.03	4.20
March	3,800	770	1,289	4.74	5.46
April	1,940	650	1,028	3.78	4.22
May	1,070	410	572	2.10	2.42
June	1,610	410	810	2.98	3.32
July	1,100	272	503	1.85	2.13
August	1,460	229	389	1.43	1.65
September	560	190	238	.88	.98
October	560	172	212	.78	.90
November	560	172	232	.85	.95
December	500	172	254	.93	1.07
The year	4,610	172	588	2.16	29.13

HIWASSEE RIVER AT MURPHY, N. C.

The station was established July 26, 1896, by E. W. Myers. It is located at the highway bridge, about 80 feet above the Atlanta, Knoxville and Northern Railroad bridge and one-half mile above the mouth of Valley River. The standard chain gage, with 24-inch box, is clamped to the top of the downstream end of the first iron crossbeam from the right bank in the space between the bridge floor and the lower chords. The length of the chain from the bottom of the weight to the index is 27.05 feet. The gage is read once each day by William Mingus. Discharge measurements are made from the sidewalk on the upstream side of the single-span highway bridge. The bridge is 195 feet long, supported by stone abutments. The initial point for soundings is the end of the iron hand rail on the right bank, upstream side of the bridge. The channel is straight for about 500 feet above and below the station. The right bank is high and rocky and will not overflow. The left bank will overflow for a short distance around the abutment. The bed of the stream is rocky and rough and makes soundings uncertain. The bed is permanent and the flow is rapid.

Bench mark No. 1 is the downstream side of the top of the stone pier at the right bank, 22.55 feet above gage datum. Bench mark No. 2 is the top of the downstream end of the first iron crossbeam from the right end of the bridge under the bridge floor; its elevation is 25.05 feet above gage datum. Bench mark No. 3 is a cut on a large white-oak tree in the grounds of the Atlanta, Knoxville and Northern Railroad station, on the left side of the street leading from the highway bridge to the town and 325 feet from the end of the bridge. Its elevation is 31.57 feet above gage datum. Bench mark No. 4 is a copper plug set in the solid rock on the right side of the river, 100 feet from the water's edge, 10 feet uphill from the foot of the hill and 500 feet up the river from the bridge. Its elevation is 21.31 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Hiwassee River at Murphy, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 6	M. R. Hall	6.60	1,747
March 28	B. S. Drane	6.75	2,226
April 28	E. C. Murphy	6.04	1,302
July 29	O. P. Hall	5.16	435
August 17	M. R. Hall	5.19	437
August 27	O. P. Hall	5.00	315
October 2	do	4.88	217
October 3	do	4.88	220
December 3	do	4.83	233

Mean daily gage height, in feet, of Hiwassee River at Murphy, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.05	5.40	8.55	7.10	6.00	6.20	5.40	5.25	4.95	4.85	4.95	4.90
2	5.05	5.40	7.35	6.85	5.95	6.25	5.50	6.50	4.95	4.85	4.90	4.90
3	5.65	5.50	6.95	6.70	5.90	5.90	5.45	5.70	5.00	4.85	4.90	4.90
4	5.85	6.60	6.75	6.95	6.30	5.75	5.40	5.30	5.00	4.90	4.95	4.90
5	5.80	6.90	6.55	6.55	5.85	6.40	5.35	6.15	5.00	4.85	5.40	4.90
6	5.70	6.25	6.60	6.45	5.85	6.75	5.45	5.40	4.95	4.85	5.05	4.90
7	5.60	6.25	6.45	6.40	5.80	6.35	5.65	5.30	4.90	4.85	4.95	4.95
8	5.60	7.60	7.95	6.70	5.80	6.50	5.45	5.20	4.90	5.90	4.95	4.85
9	5.50	6.90	7.75	6.80	5.75	5.90	5.40	5.15	5.05	5.05	4.90	4.85
10	5.50	6.45	7.35	6.55	5.75	5.85	5.65	5.10	4.95	4.90	4.90	4.90
11	5.55	7.20	9.95	6.45	5.70	6.30	5.50	5.20	4.90	4.85	4.90	4.90
12	5.95	7.35	8.20	6.30	5.70	5.90	6.15	5.10	4.90	4.85	5.15	4.90
13	5.70	6.75	7.50	6.50	5.75	5.75	6.10	5.00	4.90	4.85	5.00	4.95
14	5.70	6.45	7.10	7.65	5.70	5.65	6.10	5.00	4.90	4.85	4.95	5.05
15	5.60	6.25	6.85	7.25	5.70	5.65	5.70	5.10	5.15	4.85	5.00	4.95
16	5.55	6.20	6.70	6.90	5.65	5.60	5.55	5.15	5.45	4.85	4.95	4.90
17	5.60	9.15	6.55	6.70	5.60	5.55	5.75	5.20	5.10	4.95	5.00	4.95
18	5.90	7.30	6.45	6.55	5.60	5.50	5.50	5.20	5.05	5.05	5.45	4.85
19	5.40	6.75	6.35	6.45	5.55	5.50	5.45	5.10	4.95	4.90	5.60	4.85
20	5.35	6.50	6.25	6.40	5.55	5.50	5.45	5.20	4.95	4.90	5.00	5.05
21	5.40	6.35	6.90	6.45	6.10	5.65	5.35	5.10	4.95	4.90	5.00	5.25
22	5.35	6.20	7.10	6.25	5.55	5.45	5.35	5.10	4.95	4.85	4.95	5.00
23	5.35	6.05	11.80	6.20	5.50	5.50	5.35	5.05	4.90	4.85	4.95	5.00
24	5.35	6.00	8.75	6.15	5.50	5.45	5.30	5.05	4.90	4.90	4.95	4.95
25	5.40	5.95	7.65	6.10	5.45	5.40	5.25	5.05	4.90	4.85	4.95	4.95
26	5.35	5.85	7.15	6.25	5.45	5.45	5.25	5.00	4.85	4.85	4.95	5.00
27	5.30	5.80	6.90	6.10	5.45	5.75	5.25	5.00	4.90	4.85	4.95	4.95
28	5.35	12.00	6.75	6.05	5.45	5.85	5.25	5.00	4.90	4.85	4.90	5.05
29	5.55	.....	6.65	6.00	5.95	5.55	5.30	4.95	4.90	4.85	4.90	5.00
30	5.45	.....	7.85	5.95	5.60	5.45	5.35	4.95	4.85	4.90	4.90	4.95
31	5.40	.....	7.55	.....	5.80	.....	5.40	4.95	.....	4.95	.....	4.95

Rating table for Hiwassee River at Murphy, N. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.8	205	5.8	940	6.8	2,640	7.8	4,440
4.9	265	5.9	1,070	6.9	2,820	7.9	4,620
5.0	325	6.0	1,200	7.0	3,000	8.0	4,800
5.1	385	6.1	1,380	7.1	3,180	8.5	5,700
5.2	450	6.2	1,560	7.2	3,360	9.0	6,600
5.3	520	6.3	1,740	7.3	3,540	9.5	7,500
5.4	590	6.4	1,920	7.4	3,720	10.0	8,400
5.5	670	6.5	2,100	7.5	3,900	10.5	9,300
5.6	750	6.6	2,280	7.6	4,080	11.0	10,200
5.7	845	6.7	2,460	7.7	4,260	12.0	12,000

Rating table for 1903 same as 1902.

Estimated monthly discharge of Hiwassee River at Murphy, N. C., for 1903.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	1,135	355	698	1.70	1.96
February	12,000	590	2,498	6.09	6.34
March	11,640	1,650	3,708	9.04	10.42
April	4,170	1,135	2,143	5.23	5.83
May	1,740	630	890	2.17	2.50
June	2,550	590	1,053	2.57	2.87
July	1,470	485	695	1.70	1.96
August	2,100	295	500	1.22	1.41
September	630	235	304	.74	.83
October	1,070	235	280	.68	.78
November	630	265	320	.78	.87
December	485	235	290	.71	.82
The year	12,000	235	1,115	2.72	36.59

LITTLE TENNESSEE RIVER AT JUDSON, N. C.

This river rises in northern Georgia, with tributaries from the mountains between North Carolina and Georgia, and flows in a northwesterly direction, emptying into the Tennessee River at Lenoir, Tenn. Measurements of flow are made at Judson, N. C., below the mouth of Sawyer Branch. The area drained is mountainous and covered with forest growth. The station was established by E. W. Myers in June, 1896. It is located on the Southern Railway bridge, about one-fourth of a mile from Judson, N. C. The standard chain gage with inclosed scale is located on the downstream side of the first span from the left end of the bridge. The length of the chain from the end of the weight to the marker is 26.29 feet. The observer is R. C. Sawyer, a farmer living at Judson, N. C. The river is straight for several hundred yards above and below the station; the bottom rocky and very rough on the west side and sandy on the east side. The current is swift and considerably obstructed by two wide timber piers. The section is constant, but not a good one for measurements.

Bench mark No. 1 is the top of the angle block on the lower chord at the middle of the first span from the left end of the bridge, on the downstream side. Its elevation is 23.36 feet above gage datum. Bench mark No. 2 is a standard copper bolt set in the rock near the end of the tunnel, on the right bank, 130 feet from the end of the

bridge and 8 feet from the center of the track. Its elevation is 28.14 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Little Tennessee River at Judson, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 30	B. S. Drane	6.91	10,494
April 26	E. W. Myers	4.35	3,033
June 28	do	3.56	1,796
October 10	B. S. Drane	2.48	565
Do	do	2.46	559
August 20	do	2.86	1,097

Mean daily gage height, in feet, of Little Tennessee River at Judson, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.41	3.54	9.63	7.10	4.00	4.60	3.25	2.80	2.55	2.32	2.38	2.38
2	3.55	3.60	6.92	7.15	3.95	4.55	3.25	4.35	2.95	2.32	2.40	2.30
3	4.02	3.66	5.93	6.90	3.90	4.55	3.25	3.90	2.55	2.31	2.65	2.25
4	4.08	5.82	4.98	6.75	4.15	4.50	3.50	3.10	2.50	2.35	2.60	2.28
5	3.90	4.73	4.65	6.65	3.95	5.70	3.25	3.10	2.60	2.30	2.98	2.40
6	3.70	4.73	5.39	8.70	3.85	5.65	3.35	3.00	2.50	2.32	2.75	2.42
7	3.65	5.41	5.52	7.95	3.85	4.72	3.35	2.90	2.45	2.33	2.52	2.30
8	3.62	4.89	7.27	7.20	3.80	3.90	3.40	2.80	2.40	2.40	2.48	2.28
9	3.30	4.82	6.53	6.50	3.75	3.85	3.30	2.75	2.45	2.35	2.45	2.40
10	3.35	4.90	7.39	5.90	3.70	3.85	3.25	2.75	2.50	2.33	2.40	2.42
11	3.45	5.41	6.80	4.75	3.70	4.95	3.60	2.80	2.40	2.35	2.42	2.22
12	4.35	6.40	6.72	4.65	3.70	4.36	3.80	2.85	2.45	2.37	2.53	2.22
13	3.00	5.29	5.93	5.85	3.65	4.20	3.75	2.75	2.40	2.36	2.55	2.62
14	3.65	4.96	5.71	6.55	3.60	4.10	3.60	2.70	2.40	2.40	2.52	2.70
15	3.55	4.31	6.42	5.50	3.60	3.90	3.35	2.80	2.75	2.32	2.50	2.50
16	3.50	4.30	5.18	5.45	3.60	3.80	3.20	3.50	3.60	2.33	2.45	2.38
17	3.48	5.73	4.98	4.95	3.70	3.65	3.35	3.95	2.60	2.48	3.25	2.35
18	3.45	4.98	4.93	4.75	3.70	3.60	3.25	3.00	2.55	2.72	3.35	2.22
19	3.43	4.81	4.80	4.53	3.70	3.55	3.15	2.80	2.50	2.50	3.32	2.25
20	3.40	4.72	4.73	4.53	3.60	3.55	3.10	2.80	2.50	2.40	2.60	2.82
21	3.42	4.36	5.29	4.45	3.55	3.55	3.00	2.70	2.45	2.35	2.52	3.05
22	3.40	4.31	6.03	4.44	3.55	3.45	3.50	2.65	2.45	2.32	2.50	2.75
23	3.41	4.22	10.28	4.44	3.50	3.40	3.00	2.65	2.40	2.33	2.48	2.68
24	3.49	4.22	8.92	4.44	3.45	3.35	2.95	2.60	2.40	2.33	2.45	2.55
25	3.60	5.46	6.29	4.43	3.45	3.35	2.90	2.60	2.38	2.38	2.42	2.60
26	3.61	5.72	6.20	4.47	3.30	4.25	2.85	2.55	2.39	2.30	2.42	3.00
27	3.54	6.29	5.64	4.46	3.20	4.15	2.85	2.55	2.36	2.30	2.38	2.45
28	3.58	10.63	5.10	4.20	3.20	3.50	2.80	2.50	2.37	2.38	2.23	2.68
29	3.57	.....	5.60	4.10	3.80	3.30	3.00	2.50	2.35	2.34	2.50	2.56
30	3.58	.....	5.60	4.00	3.90	3.20	2.95	2.55	2.33	2.35	2.42	2.50
31	3.59	.....	6.65	.....	3.90	.....	3.10	2.50	.....	2.36	.....	2.43

Rating table for Little Tennessee River at Judson, N. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.2	335	3.9	2,300	5.6	5,700	7.3	9,864
2.3	405	4.0	2,460	5.7	5,920	7.4	10,142
2.4	485	4.1	2,620	5.8	6,140	7.5	10,420
2.5	575	4.2	2,800	5.9	6,360	7.6	10,776
2.6	675	4.3	2,980	6.0	6,580	7.7	11,132
2.7	775	4.4	3,180	6.1	6,825	7.8	11,488
2.8	875	4.5	3,380	6.2	7,070	7.9	11,844
2.9	985	4.6	3,580	6.3	7,315	8.0	12,200
3.0	1,100	4.7	3,780	6.4	7,560	8.5	14,200
3.1	1,220	4.8	3,980	6.5	7,805	9.0	16,200
3.2	1,340	4.9	4,180	6.6	8,050	9.5	18,450
3.3	1,460	5.0	4,380	6.7	8,295	10.0	20,700
3.4	1,580	5.1	4,600	6.8	8,540	10.5	23,100
3.5	1,720	5.2	4,820	6.9	8,785	11.0	25,500
3.6	1,860	5.3	5,040	7.0	9,030		
3.7	2,000	5.4	5,260	7.1	9,308		
3.8	2,140	5.5	5,480	7.2	9,586		

Estimated monthly discharge of Little Tennessee River at Judson, N. C., for 1903.

[Drainage area, 675 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	3,080	1,100	1,830	2.71	3.12
February	23,820	1,790	4,908	7.27	7.57
March	22,140	3,680	7,521	11.14	12.84
April	15,000	2,460	5,782	8.57	9.56
May	2,710	1,340	1,991	2.95	3.40
June	5,920	1,340	2,631	3.90	4.35
July	2,140	875	1,389	2.06	2.37
August	3,080	575	1,023	1.52	1.75
September	1,860	445	605	.90	1.00
October	775	405	459	.68	.78
November	1,520	370	669	.99	1.10
December	1,160	335	575	.85	.98
The year	23,820	335	2,449	3.63	48.82

TUCKASEGEE RIVER AT BRYSON, N. C.

Tuckasegee River rises in the southwestern part of North Carolina, at the base of Tennessee Ridge, which separates Jackson and Transylvania counties. It flows in a northwesterly direction, emptying into Little Tennessee River at Bushnell, N. C. Measurements of discharge are made at Bryson, 2 miles below the mouth of Newton Mill Creek. The drainage area is largely rough and mountainous, and covered with forest growth.

This station was originally established by E. W. Myers, June, 1896, at the Southern Railroad bridge, about 3 miles above Bryson, N. C., just below Governor Island post-office. This station was abandoned March 25, 1897, on account of the poor section. The present station was established November 7, 1897, by A. P. Davis, at the highway bridge in the town of Bryson, N. C., 2 miles below the mouth of Newton Mill Creek. The gage is a vertical rod bolted to the north pier on the right bank at the downstream side of the bridge. It is read once daily by J. M. Welch. Discharge measurements are made from the sidewalk on the downstream side of the single-span steel highway bridge. The initial point for soundings is the end of the hand rail at the left bank on the downstream side of the bridge. The channel is straight for about 600 feet above and below the station. The water is moderately swift, but the current is obstructed by the remnants of two old bridge piers. The right bank is low at the bridge and overflows to a slight extent, but all water passes beneath the bridge and its approach. The right bank is high and rocky and does not overflow. The bed is of gravel and sand and is fairly constant. Bench mark No. 1 is a copper bolt set in the stone sill beneath the large window in the northwest corner of D. K. Collins's brick store, about 80 feet east of the northeast corner of the county court-house. The window is on the side of the store nearest the court-house. The elevation of the bench mark is 22.32 feet above the zero of the gage.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tuckasegee River at Bryson, N. C., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 19	E. W. Myers	2.50	2,471
Do	do	2.50	2,484
March 27	B. S. Drane	4.35	4,435
April 23	do	2.78	2,932
April 24	do	2.63	2,748
April 25	E. W. Myers	2.70	2,928
June 26	do	1.73	1,299
June 27	do	1.70	1,225
August 17	B. S. Drane	1.25	659
August 18	do	1.49	955
Do	do	1.41	794
October 9	do	1.16	607
October 12	do	.95	419

Mean daily gage height, in feet, of Tuckasegee River at Bryson, N. C., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	1.60	4.00	3.30	2.25	2.50	1.50	1.30	1.10	0.95	1.00	0.9[illegible]
2	1.90	1.75	3.40	3.10	2.20	2.65	1.50	1.70	1.10	.95	1.00	.9[illegible]
3	2.50	2.00	3.10	2.90	2.20	2.20	1.50	1.50	1.10	.95	1.00	.9[illegible]
4	2.10	5.75	2.80	3.30	2.20	2.10	1.50	1.40	1.20	.95	1.10	.9[illegible]
5	1.90	3.15	3.00	2.90	2.10	3.05	1.65	1.50	1.10	.90	1.35	1.0[illegible]
6	1.85	2.65	3.00	2.80	2.05	3.30	1.60	1.35	1.10	.90	1.10	1.0[illegible]
7	1.70	2.95	2.90	3.30	2.00	2.70	1.55	1.25	1.05	1.00	1.00	.9[illegible]
8	1.70	3.85	4.35	6.50	2.00	2.30	1.50	1.20	1.10	1.60	1.00	1.0[illegible]
9	1.60	3.00	3.50	3.60	2.00	2.20	1.50	1.20	1.10	1.05	1.00	1.0[illegible]
10	1.70	2.70	3.60	3.40	1.95	2.30	1.80	1.20	1.10	1.00	1.00	.95
11	2.30	4.20	4.20	3.30	1.90	2.20	1.70	1.50	1.05	1.00	1.00	.9[illegible]
12	1.90	3.50	3.70	3.10	1.90	2.10	1.70	1.30	1.00	.95	1.05	1.00
13	1.75	3.00	3.30	4.75	1.90	1.95	1.95	1.25	1.00	.95	1.10	1.3[illegible]
14	1.80	2.80	3.10	4.00	1.90	1.90	1.60	1.30	1.00	.95	1.10	1.1
15	1.70	2.70	3.00	3.60	1.85	1.80	1.50	1.40	1.50	.95	1.10	1.1
16	1.60	5.00	2.80	3.40	1.80	1.75	1.50	1.50	1.40	.95	1.00	.95
17	1.60	4.90	2.70	3.20	1.80	1.70	1.70	1.25	1.20	1.30	4.00	.9[illegible]
18	1.60	3.50	2.60	3.10	1.75	1.75	1.45	1.40	1.10	1.10	1.75	.9[illegible]
19	1.55	3.10	2.50	3.00	1.75	1.65	1.50	1.40	1.05	1.05	1.20	1.0[illegible]
20	1.55	3.00	2.40	3.30	1.70	1.85	1.40	1.30	1.05	1.00	1.10	1.0[illegible]
21	1.60	2.80	2.80	3.10	1.75	1.70	1.40	1.20	1.05	1.00	1.10	1.3[illegible]
22	1.55	2.50	4.45	2.90	1.75	1.65	1.35	1.20	1.00	1.00	1.10	1.15
23	1.50	2.30	8.20	2.75	1.70	1.65	1.35	1.20	1.00	.95	1.10	1.1[illegible]
24	1.60	2.25	5.15	2.60	1.70	1.55	1.30	1.15	1.00	.95	1.05	1.2[illegible]
25	1.55	2.20	4.00	2.70	1.65	1.55	1.30	1.15	1.00	.95	1.00	1.40
26	1.50	2.10	3.60	2.60	1.60	1.75	1.25	1.10	1.00	.95	1.00	1.4[illegible]
27	1.55	2.50	3.30	2.50	1.60	1.65	1.25	1.10	1.00	.95	.90	1.10
28	1.80	7.80	3.10	2.40	1.65	1.60	1.60	1.10	.95	.95	.90	1.30
29	1.80	.....	3.20	2.35	1.95	1.55	1.40	1.10	.95	.95	.95	1.10
30	1.80	.....	4.30	2.30	2.20	1.50	1.40	1.25	.95	.95	1.00	1.1[illegible]
31	1.70	.....	3.60	.....	2.10	.....	1.35	1.10	.....	1.00	.....	1.[illegible]

Rating table for Tuckasegee River at Bryson, N. C., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.9	380	2.7	2,850	4.5	7,220	6.3	14,940
1.0	460	2.8	3,050	4.6	7,530	6.4	15,520
1.1	550	2.9	3,250	4.7	7,840	6.5	16,100
1.2	640	3.0	3,460	4.8	8,160	6.6	16,680
1.3	730	3.1	3,670	4.9	8,480	6.7	17,260
1.4	830	3.2	3,890	5.0	8,800	6.8	17,840
1.5	940	3.3	4,110	5.1	9,125	6.9	18,420
1.6	1,060	3.4	4,330	5.2	9,475	7.0	19,000
1.7	1,180	3.5	4,560	5.3	9,850	7.2	20,160
1.8	1,310	3.6	4,800	5.4	10,250	7.4	21,320
1.9	1,450	3.7	5,040	5.5	10,675	7.6	22,480
2.0	1,600	3.8	5,290	5.6	11,125	7.8	23,640
2.1	1,760	3.9	5,540	5.7	11,600	8.0	24,800
2.2	1,930	4.0	5,800	5.8	12,100	8.2	25,960
2.3	2,100	4.1	6,070	5.9	12,625	8.4	27,120
2.4	2,280	4.2	6,350	6.0	13,200	8.6	28,280
2.5	2,470	4.3	6,630	6.1	13,780	8.8	29,440
2.6	2,660	4.4	6,920	6.2	14,360	9.0	30,600

Table well determined to 3 feet gage height. Above 5 feet 1901, 1902, and 1903 rating tables are the same.

Estimated monthly discharge of Tuckasegee River at Bryson, N. C., in 1903.

[Drainage area, 662 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,470	940	1,258	1.90	2.19
February	23,640	1,060	4,502	6.80	7.08
March	25,960	2,280	5,102	7.71	8.89
April	16,100	2,100	4,123	6.23	6.95
May	2,015	1,060	1,467	2.22	2.56
June	4,110	940	1,683	2.54	2.83
July	1,525	685	952	1.44	1.66
August	1,180	550	725	1.10	1.27
September	940	420	531	.80	.89
October	1,060	380	467	.71	.82
November	5,800	380	704	1.06	1.18
December	1,310	380	539	.81	.93
The year	25,960	380	1,838	2.78	37.25

TENNESSEE RIVER AT KNOXVILLE, TENN.

This station was originally established by the United States Weather Bureau at the old county highway bridge, which has been torn down and replaced by a new bridge. Instead of placing the gage at the new bridge, it was decided to move it down the river in order to get below some shoals and wing dams which have been put in for boating. A temporary gage was put in at the Knoxville and Augusta Railroad bridge, a half mile below the highway bridge, and was used during the greater part of the year 1899. In the latter part of that year a new permanent gage was established, and readings from it began on November 1, 1899. The new gage is on the right bank of the river, just below the mouth of West Knoxville Bayou, and about 1,000 feet below the temporary gage at the Knoxville and Augusta Railroad bridge. The gage, which is graduated to feet and tenths, is in two sections—the first, a sloping section, made of a 2 by 4 inch pine timber spiked on top of an 8 by 8 inch oak sill well bolted to piles and embedded in crushed stone, reading from −2 to +12 feet; the second, a vertical section, attached to one of the bents of the railroad trestle across West Knoxville Bayou, about 50 feet from the bank of the river and from the sloping gage, reading from 12 to 36.5 feet. The gage is fastened to the upstream post of the bent, facing away from the river. The zero of the gage is 804.3 feet above sea level. The gage was located for the United States Weather Bureau by the United States Engineer Corps. Daily records are kept by the United States Weather Bureau and are furnished to the Geological Survey. Until recently discharge measurements have been made from the Cherokee Bridge, about 2½ miles downstream from the Gay street or county bridge, at which measurements are now made, and which is one-half mile above the Knoxville and Augusta railroad bridge. The Gay Street Bridge has seven spans, with a total length of 1,570 feet. The floor of the bridge is about 100 feet above low water. The initial point for soundings is the end of the bridge on the right-bank, downstream side. The channel is straight for one-half mile above and for 1,000 feet below the station. The right bank will overflow for about 400 feet and the left bank for 200 feet, beyond which points a steep high bluff begins on both sides of the river. The bed is of rocks and gravel, and is rough and probably permanent. The current is swift and somewhat broken by the rough bed and by the remains of old piers. The bench mark is a cross in the stone on the east corner of the base of the right-bank pier of the Knoxville and Augusta Railroad bridge. Its elevation is 2.4 feet above the zero of the gage and 807 feet above sea level.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Tennessee River at Knoxville, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 24	O. P. Hall	24.30	126,376
July 27	do	.86	4,759
August 25	do	.70	4,366
Do	do	.70	4,344
October 5	do	.01	2,584
October 22	M. R. Hall	.27	3,135

Mean daily gage height, in feet, of Tennessee River at Knoxville, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	2.40	14.60	10.90	5.00	3.10	1.90	1.20	0.60	−0.20	0.00	0.20
2	1.80	2.30	13.40	9.20	4.60	2.90	1.70	1.20	.50	− .20	.00	.20
3	2.00	2.30	9.70	7.60	4.30	4.70	1.50	2.00	.40	− .20	.10	.20
4	2.70	3.20	7.30	7.50	4.10	3.80	1.60	1.80	.40	− .10	.10	.10
5	5.20	9.40	5.70	8.50	4.10	3.20	1.80	2.70	.60	.00	.20	.10
6	4.40	9.50	6.00	8.20	4.00	3.50	2.10	2.00	.70	.00	.20	.10
7	3.80	6.80	6.10	6.80	3.60	5.90	2.20	2.00	.40	.00	.50	.10
8	3.20	6.00	7.80	14.80	3.40	6.20	.....	1.50	.30	− .10	.70	.10
9	2.90	7.60	11.20	24.10	3.20	5.50	1.90	1.20	.30	.10	.60	.10
10	2.50	6.70	9.90	17.80	3.10	4.40	1.60	1.00	.30	.10	.40	.10
11	2.20	6.00	8.20	12.00	3.00	4.60	1.40	1.10	.30	.80	.30	.10
12	2.30	7.00	8.10	8.90	2.80	4.70	1.70	1.60	.60	.70	.20	.10
13	2.90	8.60	8.80	9.20	2.60	4.20	2.20	1.50	.30	.30	.20	.20
14	2.70	7.70	8.30	13.90	2.60	3.40	3.00	1.30	.20	.20	.30	.10
15	2.20	6.00	5.80	12.80	2.60	3.00	4.30	1.80	.30	.20	.30	.10
16	2.20	6.70	5.80	11.70	2.60	2.60	3.00	1.20	.20	.20	.30	.20
17	2.30	15.60	5.20	10.60	2.60	2.40	2.20	1.10	.20	.10	1.00	.30
18	2.20	19.90	4.70	9.80	2.40	2.20	1.90	1.80	.20	.10	1.80	.20
19	2.00	15.80	4.30	8.40	2.30	2.10	1.90	1.70	.70	.20	2.50	.20
20	1.90	8.90	3.90	7.40	2.10	2.10	2.20	1.70	.60	.20	2.20	.20
21	1.80	6.90	4.00	8.00	2.00	2.00	1.70	1.60	.50	.20	1.60	.50
22	1.60	5.80	4.30	7.60	2.00	2.10	1.50	1.20	.40	.20	1.00	1.00
23	1.70	5.00	10.90	6.70	2.00	2.00	1.20	1.00	.20	.20	.90	1.40
24	1.80	4.50	24.00	6.50	2.00	2.30	1.20	.90	.20	.10	.80	1.20
25	1.80	4.00	20.40	5.90	1.90	2.10	1.10	.70	.20	.10	.70	1.00
26	1.80	3.70	13.20	5.80	1.80	1.80	.90	.70	.10	.00	.60	1.00
27	1.80	3.40	9.40	5.80	1.80	1.70	.90	.60	.00	.00	.40	1.30
28	1.80	8.00	7.40	7.70	1.70	2.00	.80	.60	.00	.00	.30	1.40
29	1.80	.....	6.40	6.70	1.90	1.90	.80	.50	− .10	− .10	.20	1.50
30	2.00	.....	6.90	5.70	2.50	1.90	.80	.60	− .10	− .10	.20	1.00
31	2.20	.....	9.90	.....	3.30	.....	1.20	.50	.....	− .10	.....	.90

Rating table for Tennessee River at Knoxville, Tenn., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	2,180	2.3	9,620	5.6	22,620	14.5	68,390
.1	2,370	2.4	9,980	5.8	23,480	15.0	71,290
.0	2,570	2.5	10,340	6.0	24,340	15.5	74,190
.1	2,780	2.6	10,710	6.2	25,220	16.0	77,090
.2	3,000	2.7	11,080	6.4	26,100	16.5	79,990
.3	3,230	2.8	11,450	6.6	26,990	17.0	82,890
.4	3,470	2.9	11,820	6.8	27,890	17.5	85,790
.5	3,730	3.0	12,190	7.0	28,790	18.0	88,690
.6	4,000	3.1	12,570	7.2	29,710	18.5	91,590
.7	4,280	3.2	12,950	7.4	30,630	19.0	94,490
.8	4,570	3.3	13,330	7.6	31,560	19.5	97,390
.9	4,870	3.4	13,710	7.8	32,500	20.0	100,290
1.0	5,180	3.5	14,090	8.0	33,440	20.5	103,190
1.1	5,500	3.6	14,480	8.5	35,840	21.0	106,090
1.2	5,820	3.7	14,870	9.0	38,290	21.5	108,990
1.3	6,150	3.8	15,260	9.5	40,790	22.0	111,890
1.4	6,480	3.9	15,650	10.0	43,340	22.5	114,790
1.5	6,820	4.0	16,040	10.5	45,940	23.0	117,690
1.6	7,160	4.2	16,840	11.0	48,590	23.5	120,590
1.7	7,500	4.4	17,640	11.5	51,290	24.0	123,490
1.8	7,850	4.6	18,450	12.0	54,040	24.5	126,390
1.9	8,200	4.8	19,270	12.5	56,840	25.0	129,290
2.0	8,550	5.0	20,900	13.0	59,690		
2.1	8,900	5.2	20,930	13.5	62,590		
2.2	9,260	5.4	21,770	14.0	65,490		

Estimated monthly discharge of Tennessee River at Knoxville, Tenn., for 1903.

[Drainage area, 8,990 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	20,930	7,160	9,923	1.10	1.27
February	99,710	9,620	30,952	3.44	3.58
March	123,490	15,650	38,605	4.29	4.95
April	124,070	23,050	42,133	4.69	5.24
May	20,090	7,500	11,664	1.30	1.50
June	25,220	7,500	12,904	1.44	1.60
July	17,240	4,570	7,757	.86	.99
August	11,080	3,730	6,217	.69	.79
September	4,280	2,370	3,298	.37	.41
October	4,570	2,180	2,793	.31	.36
November	10,340	2,570	4,216	.47	.52
December	6,820	2,780	3,867	.43	.50
The year	124,070	2,180	14,527	1.62	21.71

FRENCH BROAD RIVER AT OLDTOWN, NEAR NEWPORT, TENN.

This was originally one of the temporary stations established in connection with the general hydrographic study of the southern Appalachian region.

The original gage put in at this station was carried away with the old bridge by flood early in the spring of 1902.

The wire gage was established on the new bridge October 27, 1902, by B. S. Drane. The distance from the zero of the scale to the outer rim of the pulley was 2.80 feet; the length of the wire from the end of the weight to the marker was 30.38 feet. The zero of the scale was placed directly opposite the center of the first intermediate post on the second span from the southwest end. This gage was referred to the top of the hexagonal nut on the center bolt in the lower chord of the bridge below and slightly downstream from the zero of the gage. It was 26.60 feet above gage datum. The wire gage was replaced April 29, 1903, by a standard chain gage, with inclosed scale, with its zero 133 feet from initial point for soundings. This gage was made to read the same as the one which it replaced. The length of the chain from the end of the weight to the marker is 28 feet. Discharge measurements are made from the downstream side of the steel highway bridge, in four spans, to which the gage is attached. The initial point for soundings is the end of the guard rail at the left end of the bridge, on the downstream side. The channel is straight for about 600 feet above and below the station. The velocity is moderately swift,

well distributed, and can be measured at all stages. Both banks are high and wooded, and all water passes beneath the bridge at all stages. The section is smooth and regular, and the bed is of gravel and sand, not subject to much change.

Bench mark No. 1 is a point marked in white paint on the sharp, rectangular corner of the angle iron connection between the floor beam and the first strut on the downstream side in the second span from the left end of the bridge. This point is toward the right bank and is 25.84 feet above gage datum. Bench mark No. 2 is the top of the copper bolt set in a bowlder projecting from the hillside on the left bank 175 feet downstream from the center line of the bridge, 8 feet from the center of the road, and about 4 feet above ground. This rock is the first smooth-faced ledge of limestone outcropping close to the road. The face next the road is nearly vertical for a length of 4 feet. The elevation of the bench mark is 29.52 feet above gage datum.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of French Broad River at Oldtown, near Newport, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second feet.*
February 12	E. W. Myers	4.32	12,874
March 17	do	2.87	5,059
April 2	B. S. Drane	4.11	10,660
April 30	E. C. Murphy	2.58	4,611
June 30	B. S. Drane	2.25	3,532
Do	do	2.24	3,268
August 12	do	1.80	2,279
Do	M. R. Hall	1.82	2,246
September 2	B. S. Drane	1.45	1,167
October 14	do	1.31	986
Do	do	1.31	992

Mean daily gage height, in feet, of French Broad River at Oldtown, near Newport, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.10	2.00	5.50	4.80	2.50	2.40	2.20	2.00	1.50	1.20	1.20	1.20
2	2.20	1.90	4.40	4.00	2.50	3.30	2.10	2.00	1.50	1.20	1.20	1.30
3	2.40	2.00	3.90	3.60	2.40	3.20	2.00	2.10	1.40	1.20	1.20	1.30
4	2.50	3.80	3.20	4.30	2.80	2.80	2.20	2.00	1.40	1.20	1.50	1.30
5	2.50	3.70	3.00	3.70	2.60	2.50	2.00	2.10	1.50	1.20	1.60	1.30
6	2.40	3.00	3.50	3.40	2.50	4.50	2.40	2.00	1.50	1.30	1.70	1.30
7	2.30	2.70	3.80	3.20	2.40	4.70	2.30	1.90	1.40	1.30	1.60	1.30

Mean daily gage height, in feet, of French Broad River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	2.20	4.60	3.80	12.00	2.30	4.60	2.20	1.80	1.40	1.40	1.50	1.20
9	2.10	4.00	4.80	5.90	2.30	4.20	2.10	1.60	1.40	1.50	1.40	1.20
10	2.00	3.30	4.00	4.60	2.30	4.00	2.00	1.70	1.30	1.60	1.30	1.20
11	1.90	3.20	4.20	3.80	2.30	4.10	2.10	1.90	1.40	1.50	1.30	1.20
12	2.10	4.40	4.60	3.40	2.20	3.70	2.40	1.80	1.30	1.40	1.30	1.20
13	2.40	3.80	4.50	4.40	2.20	3.20	2.70	1.70	1.30	1.40	1.30	1.20
14	2.20	3.20	3.80	5.80	2.20	2.80	2.60	1.60	1.30	1.30	1.30	1.30
15	2.20	2.90	3.20	5.20	2.10	2.60	2.20	1.70	1.40	1.30	1.30	1.30
16	2.20	3.90	3.00	4.70	2.10	2.50	2.00	1.80	1.40	1.30	1.20	1.30
17	2.10	6.50	2.90	4.20	2.10	2.40	2.20	1.90	1.50	1.40	1.50	1.20
18	2.00	4.70	2.80	3.80	2.10	2.30	2.00	2.00	1.50	1.40	2.10	1.20
19	2.00	3.60	2.70	3.50	2.10	2.30	1.90	1.90	1.50	1.40	1.80	1.20
20	1.90	3.10	2.60	3.40	2.00	2.30	1.90	1.80	1.40	1.30	1.60	1.20
21	2.00	3.00	2.70	3.50	2.00	2.40	1.80	1.70	1.40	1.30	1.50	1.50
22	2.10	2.80	3.30	3.30	2.10	2.20	1.80	1.70	1.30	1.30	1.50	1.70
23	2.00	2.70	11.80	3.40	2.00	2.50	1.80	1.60	1.30	1.20	1.50	1.50
24	1.90	2.60	7.50	3.10	2.00	2.30	1.70	1.60	1.30	1.20	1.40	1.40
25	1.90	2.50	6.40	3.00	2.00	2.10	1.70	1.60	1.30	1.20	1.40	1.50
26	1.90	2.40	4.90	2.90	1.90	2.20	1.70	1.50	1.30	1.20	1.30	1.60
27	2.00	2.30	3.90	2.80	1.90	2.30	1.60	1.50	1.20	1.30	1.30	1.50
28	1.90	6.50	3.40	2.70	2.00	2.50	1.60	1.50	1.30	1.30	1.30	1.50
29	2.00	.....	3.20	2.60	2.10	2.40	1.60	1.40	1.30	1.20	1.20	1.40
30	2.10	.....	5.60	2.60	2.40	2.30	1.90	1.70	1.20	1.20	1.20	1.40
31	2.00	.....	5.30	.....	2.90	.....	1.80	1.60	.....	1.20	.....	1.40

Rating table for French Broad River at Oldtown, near Newport, Tenn., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	735	2.9	5,440	4.6	14,050	6.3	25,100
1.3	965	3.0	5,820	4.7	14,700	6.4	25,750
1.4	1,200	3.1	6,220	4.8	15,350	6.5	26,400
1.5	1,440	3.2	6,630	4.9	16,000	6.6	27,050
1.6	1,685	3.3	7,060	5.0	16,650	6.7	27,700
1.7	1,935	3.4	7,510	5.1	17,300	6.8	28,350
1.8	2,190	3.5	7,980	5.2	17,950	6.9	29,000
1.9	2,450	3.6	8,460	5.3	18,600	7.0	29,650
2.0	2,715	3.7	8,950	5.4	19,250	7.5	32,900
2.1	2,985	3.8	9,460	5.5	19,900	8.0	36,150
2.2	3,265	3.9	9,980	5.6	20,550	9.0	42,650
2.3	3,545	4.0	10,520	5.7	21,200	10.0	49,150
2.4	3,830	4.1	11,070	5.8	21,850	11.0	55,650
2.5	4,120	4.2	11,640	5.9	22,500	12.0	62,150
2.6	4,420	4.3	12,220	6.0	23,150		
2.7	4,740	4.4	12,810	6.1	23,800		
2.8	5,080	4.5	13,420	6.2	24,450		

Estimated monthly discharge of French Broad River at Oldtown, near Newport, Tenn., for 1903.

[Drainage area, 1,737 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	4,120	2,450	3,030	1.74	2.01
February	26,400	2,450	8,327	4.79	4.99
March	60,850	4,420	12,877	7.41	8.54
April	62,150	4,420	11,597	6.68	7.45
May	5,440	2,450	3,382	1.95	2.25
June	14,700	2,985	6,061	3.49	3.89
July	4,740	1,685	2,780	1.60	1.84
August	2,985	1,200	2,108	1.21	1.39
September	1,440	735	1,139	.66	.74
October	1,685	735	975	.56	.65
November	2,985	735	1,250	.72	.80
December	1,935	735	1,045	.60	.69
The year	62,150	735	4,548	2.62	35.24

PIGEON RIVER AT NEWPORT, TENN.

The station was established September 4, 1900, by E. W. Myers. It is located at the highway bridge in the eastern part of Newport, Tenn., 1 mile from the railroad station and 1 mile above the dam of the Newport Flouring Mill, out of reach of backwater. On April 30, 1903, the old wire gage was replaced by a standard chain gage with inclosed scale fastened to the lower chord of the bridge on the downstream side, approximately at the same location as the old gage. The new gage was made to read the same as the one which it replaced. The gage is read once each day by S. R. McSween. Since it was first established the gage has been damaged several times, and the records are continuous only from December 14, 1902. Discharge measurements are made from the lower side of the single-span steel highway bridge to which the gage is attached. The initial point for soundings is the end of the hand rail over the left bank on the downstream side of the bridge. The channel is straight for about 300 feet above and 200 feet below the station. The section is deep, rough, and irregular in shape; the velocity is poorly distributed and about 50 feet of the total width at low stages is backwater or has a negative velocity. The right bank is low and overflows to some extent, but all water passes beneath the bridge and its approach. The left bank is a high vertical rock

cliff. The bed of the stream is rocky near the left bank and sandy near the right bank.

Bench mark No. 1 is the top surface of the outer left corner of the plate at the bottom of the floor-beam hanger to the left of the zero of the gage. When the gage reads zero the water surface is 26.87 feet below this bench mark. Bench mark No. 2 is the top of a copper plug set in cement on the top of a limestone outcrop about 5 feet upstream and 3 feet to the left of the end of the upstream hand rail on the left bank. When the gage reads zero the water surface is 32.61 feet below the top of the bolt.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Pigeon River at Newport, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 12	E. W. Myers	3.98	3,450
February 18	do	4.12	4,862
March 17	do	2.58	2,031
April 2	B. S. Drane	3.50	3,586
April 30	E. C. Murphy	2.46	1,912
June 29	B. S. Drane	1.59	620
June 30	do	1.51	649
August 12	do	1.41	773
September 2	do	.97	367
Do	do	.97	349
October 13	do	.82	249
Do	do	.82	272
November 20	do	1.12	424

Mean daily gage height, in feet, of Pigeon River at Newport, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.85	2.85	(a)	3.90	2.40	2.20	1.70	1.50	1.00	0.70	0.80	0.85
2	2.87	2.85	.....	3.50	2.30	2.10	1.60	1.50	1.00	.70	.85	.80
3	2.85	2.85	3.30	3.40	2.30	2.30	1.70	1.50	1.00	.70	.85	.80
4	2.87	5.82	3.30	4.90	2.20	2.30	1.60	1.40	1.00	.70	.85	.85
5	2.77	3.67	3.20	3.70	2.10	2.90	1.60	1.40	.95	.75	.90	.85
6	2.84	3.07	3.10	3.10	2.10	5.50	1.50	1.30	.90	.75	.90	.85
7	2.85	(a)	3.00	4.90	2.10	3.40	1.60	1.30	.90	.70	.85	.85
8	2.84	.....	4.30	11.00	2.00	3.30	1.50	1.20	.90	.85	.85	.90
9	2.85	.....	3.50	6.70	2.00	3.00	1.50	1.20	.90	1.55	.85	.90
10	2.84	.....	3.20	4.30	1.90	2.70	1.60	1.20	.95	1.00	.85	.80
11	(a)	.....	3.20	3.70	1.90	2.50	1.50	1.60	.95	.80	.90	.75

a No record.

Mean daily gage height, in feet, of Pigeon River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
12	.....	.....	3.10	4.20	1.80	2.40	1.60	1.50	0.85	0.80	0.90	0.70
13	.....	.....	3.10	5.70	1.80	2.30	1.50	1.20	.80	.80	.90	1.15
14	.....	.....	3.00	4.80	1.80	2.20	1.50	1.10	.80	.80	.90	1.15
15	.....	.....	2.80	4.10	1.70	2.10	1.50	2.00	.80	.80	.95	1.00
16	.....	.....	2.70	3.90	1.70	2.10	1.60	2.60	.85	.80	.95	.95
17	.....	.....	2.70	3.70	1.70	2.10	1.90	2.40	1.45	.85	1.70	.85
18	2.85	.....	2.60	3.50	1.80	2.00	1.70	2.00	1.30	1.20	1.80	.65
19	2.85	.....	2.60	3.50	1.70	2.00	1.80	1.50	1.00	.85	1.40	1.55
20	2.85	.....	2.50	3.40	1.70	1.90	1.70	1.40	.95	.80	1.10	1.55
21	2.85	.....	2.40	3.20	1.70	1.90	1.50	1.30	.90	.80	1.00	1.45
22	2.85	.....	2.50	3.20	1.70	1.90	1.40	1.30	.85	.80	1.00	1.35
23	2.85	.....	10.50	3.10	1.80	1.90	1.40	1.20	.80	.80	1.00	1.20
24	2.85	.....	5.80	3.10	1.80	1.80	1.40	1.20	.80	.80	.95	1.10
25	2.85	.....	5.00	3.10	1.70	1.80	1.30	1.10	.80	.80	.95	1.15
26	2.87	.....	3.90	3.00	1.80	1.80	1.20	1.00	.80	.75	.95	1.20
27	2.88	.....	3.30	2.90	1.80	1.70	1.20	1.00	.85	.75	1.00	1.20
28	2.87	.....	3.10	2.80	1.80	1.80	1.20	1.00	.80	.75	1.00	1.10
29	2.88	.....	3.50	2.60	1.90	1.70	1.20	1.10	.70	.75	1.00	1.05
30	2.87	.....	6.20	2.40	2.00	1.70	1.40	1.00	.70	.80	.95	1.00
31	2.85	.....	4.20	.....	2.20	.....	1.60	1.00	.....	.80	.....	.90

Rating table for Pigeon River at Newport, Tenn., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	160	1.6	756	2.6	2,090	3.6	3,805
.7	210	1.7	854	2.7	2,240	3.7	4,000
.8	260	1.8	962	2.8	2,390	3.8	4,195
.9	312	1.9	1,080	2.9	2,550	3.9	4,390
1.0	366	2.0	1,210	3.0	2,710	4.0	4,590
1.1	420	2.1	1,350	3.1	2,870	4.1	4,790
1.2	478	2.2	1,490	3.2	3,050	4.2	4,995
1.3	538	2.3	1,640	3.3	3,235	4.4	5,420
1.4	600	2.4	1,790	3.4	3,425	4.6	5,860
1.5	670	2.5	1,940	3.5	3,615	4.8	6,310

Table uncertain above 4 feet gage height. Differences from 4.8 feet, 225 per tenth.

Estimated monthly discharge of Pigeon River at Newport, Tenn., for 1903.

[Drainage area, 655 square miles.]

Month.	Discharge in second feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January 1–10 and 18–31 [a]	.....	.....	2,470	3.77	3.36
February 1–6 [a]	.....	.....	3,962	6.05	1.35
March 3–31 [a]	.....	.....	4,076	6.22	6.71
April	20,260	1,790	4,704	7.18	8.01
May	1,790	854	1,112	1.70	1.96
June	7,885	854	1,741	2.66	2.97
July	1,080	478	701	1.07	1.23
August	2,090	366	655	1.00	1.15
September	635	210	319	.49	.55
October	713	210	275	.42	.48
November	962	260	373	.57	.64
December	713	185	380	.58	.67

[a] No record for missing days.

NOLICHUCKY RIVER NEAR GREENEVILLE, TENN.

This station was established May 7, 1903, by E. W. Myers, assisted by B. S. Drane. It is located at Jones's bridge, 5 miles southeast of Greeneville, Tenn., which is the nearest railroad station. The standard chain gage, with inclosed scale, is nailed to wooden blocks bolted to the lower chord of the bridge on the upstream side midway between the second and third struts from the right bank. The length of the chain from the end of the weight to the marker is 33.63 feet. The gage is read once each day by G. H. Jones. Discharge measurements are made from the downstream side of the two-span steel highway bridge to which the gage is attached. The initial point for soundings is the left end of the top bar of the downstream hand rail. The channel is straight for about 700 feet above and below the station. The right bank is high, but at flood stages part of the water will pass around the end of the bridge. The left bank is high and can never overflow. The section is regular, and the bed is composed of pebbles and small stones and is not subject to change. The velocity is uniform and well distributed except at extreme low water (below gage height 0.50 foot), when the middle pier and a small bar of gravel and small stones throw the current toward both banks.

Bench mark No. 1 is a standard iron bench-mark post of the United States Geological Survey set on the left bank just below the bridge. It is 5.5 feet downstream from the left end of the bridge, and is said to be above high-water mark. Its elevation above gage datum is 26.80 feet. Bench mark No. 2 is the upper outer edge of the outer

eyebar of the lower chord of the bridge, 3.6 feet to the right of the center of the third strut from the bank. The point is marked by a spot of white paint and the letters "B. M." Its elevation above gage datum is 32.03 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Nolichucky River near Greeneville, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 7	E. W. Meyers	1.48	2,358
Do	do	1.48	2,351
July 1	B. S. Drane	.61	866
August 13	M. R. Hall	.47	866
September 3	B. S. Drane	.19	588
October 15	do	.01	400
Do	do	.00	383

Mean daily gage height, in feet, of Nolichucky River near Greeneville, Tenn., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.00	0.60	0.70	0.20	0.00	0.00	0.10
2		3.00	.50	.70	.20	.00	.00	.04
3		1.80	.50	.80	.20	.00	.00	.08
4		1.70	.70	1.00	.20	.00	.01	.03
5		1.30	.60	.90	.20	.00	.16	.04
6		1.80	.70	.80	.10	.00	.15	.17
7		2.80	.80	.60	.10	.05	.01	.09
8		2.10	.70	.50	.10	.10	.00	.01
9	1.40	1.60	.60	.40	.10	.20	.08	.05
10	1.30	1.40	.50	.30	.10	.50	.05	.14
11	1.30	1.90	.60	.60	.30	.30	.01	.10
12	1.20	1.50	.60	.70	.20	.10	.06	-.01
13	1.30	1.30	1.00	.50	.20	.20	.05	.10
14	1.30	1.10	1.70	.40	.10	.05	.10	.30
15	1.40	1.00	1.10	.40	.10	.06	.09	.06
16	1.30	1.00	.70	.50	.00	.00	.10	.09
17	1.10	.90	.70	.60	.10	.00	.50	-.09
18	1.10	.90	.70	1.00	.80	.00	1.60	.00
19	1.00	.80	.70	.70	.40	.10	.80	-.01
20	1.00	.80	.60	.70	.20	.13	.50	.70
21	1.00	.80	.50	.50	.20	.00	.20	.90
22	.90	1.00	.50	.40	.10	.01	.20	.60
23	.90	.80	.40	.40	.10	.00	.20	.40
24	.90	1.10	.40	.30	.10	.00	.20	.19
25	.80	.80	.40	.30	.10	-.01	.01	.30
26	.80	.70	.50	.30	.10	-.03	.12	.50
27	.70	.70	.40	.20	.00	.00	.10	.40
28	.70	.80	.30	.20	.00	-.01	.04	.30
29	.70	.80	.30	.20	.00	-.05	.06	.30
30	.90	.80	.50	.20	.00	-.05	.05	.30
31	1.10		1.00	.20		.00		.19

Rating table for Nolichucky River near Greeneville, Tenn., from May 9 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
-0.1	312	.7	1,075	1.5	2,395	2.3	4,030
.0	388	.8	1,200	1.6	2,595	2.4	4,235
+ .1	469	.9	1,335	1.7	2,800	2.5	4,440
.2	557	1.0	1,485	1.8	3,005	2.6	4,645
.3	649	1.1	1,645	1.9	3,210	2.7	4,850
.4	746	1.2	1,815	2.0	3,415	2.8	5,055
.5	850	1.3	2,000	2.1	3,620	2.9	5,260
.6	960	1.4	2,195	2.2	3,825	3.0	5,465

Estimated monthly discharge of Nolichucky River near Greeneville, Tenn., for 1903.

[Drainage area, 1,099 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 9–31	2,195	1,075	1,590	1.45	1.24
June	5,465	1,075	2,033	1.85	2.06
July	2,800	649	1,037	.94	1.09
August	1,485	557	886	.81	.93
September	1,200	388	521	.47	.53
October	850	350	434	.40	.46
November	2,595	388	576	.52	.58
December	1,335	312	571	.52	.60

HOLSTON RIVER (SOUTH FORK) AT BLUFF CITY, TENN.

This station was originally established by the United States Weather Bureau at the highway bridge at Bluff City, Tenn. Readings were begun July 17, 1900, by the United States Geological Survey in connection with the general hydrographic investigation of the Southern Apalachian region. The gage, which is the property of the United States Weather Bureau, is a 4 by 8 inch timber bolted to the downstream side of the first channel pier from the right bank. It is read once each day by B. N. Edwards. Discharge measurements are made from the lower side of the four-span highway bridge to which the gage is attached. This bridge is a short distance below the Virginia and Southwestern Railroad bridge. The initial point for soundings is the end of the guard rail on the downstream side of the bridge over the left abutment. The channel is straight above the bridge for a distance of 300 feet, to the bridge of the Virginia and Southwestern Railroad. The channel is straight for about 100 feet below the bridge.

The bed is rocky and permanent. The bottom is very rough and rocky ledges just above and below the bridge cause back currents, eddies, and sudden variations in the velocity. Both banks are high, wooded, and do not overflow. The gage is referred to a United States Geological Survey bronze bench-mark tablet set in the upstream side of the capstone of the left abutment. When the gage reads zero this bench mark is 20.44 feet above the water surface. Its elevation above sea level is 1,389 feet.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of South Fork of Holston River at Bluff City, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 9	B. S. Drane	2.10	1,604
March 18	do	1.55	1,432
April 1	do	3.50	3,522
May 9	E. W. Myers	1.50	1,310
Do	do	1.50	1,292
July 2	B. S. Drane	.40	375
Do	do	.40	420
August 14	do	.36	406
Do	M. R. Hall	.37	310
September 4	B. S. Drane	.09	241
Do	do	.16	229
Do	do	.11	225
October 16	do	.05	204
Do	do	.08	250
Do	do	.07	192
November 21	do	.40	316

Mean daily gage height, in feet, of South Fork of Holston River at Bluff City, Tenn., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.90	1.04	5.00	3.50	3.40	0.80	0.60	0.50	0.40	0.10	0.10	0.00
2	1.00	1.04	3.30	3.10	3.10	.80	.60	.70	.30	.10	.10	.10
3	2.00	1.03	2.80	2.90	1.90	.80	.50	.50	.20	.10	.10	.00
4	3.00	3.02	2.40	4.10	2.10	.70	.50	.50	.10	.10	.10	.10
5	2.80	4.01	2.10	3.70	1.80	.70	.50	.50	.20	.10	.20	.30
6	2.00	3.90	2.00	3.00	1.80	.70	.50	.40	.20	.10	.20	.20
7	1.80	2.30	1.90	2.90	1.60	.70	.90	.40	.10	.10	.20	.00
8	1.30	2.40	2.00	3.80	1.50	.70	.50	.40	.10	.10	.20	.00
9	1.10	2.10	2.10	4.50	1.50	.60	.40	.30	.10	.30	.10	.30
10	1.10	1.90	2.00	3.70	1.50	.60	.40	.30	.10	.30	.10	.20
11	1.40	2.60	2.00	3.00	1.40	.90	.50	.40	.20	.10	.00	.00
12	1.80	4.10	2.40	2.60	1.30	.60	.60	.60	.20	.10	.10	.00
13	1.60	3.30	2.40	2.50	1.40	.60	3.00	.60	.20	.10	.10	.30
14	1.40	2.80	2.10	2.70	1.30	.60	2.10	.50	.20	.10	.10	.30
15	1.40	2.30	2.00	3.00	1.20	.60	1.30	.50	.20	.10	.10	.30
16	1.60	2.50	1.90	3.40	1.10	.60	1.00	.40	.10	.10	.10	.10

Mean daily gage height, in feet, of South Fork of Holston River, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	1.30	9.40	1.70	3.10	1.10	.60	.80	.30	.20	.10	1.30	.10
18	1.10	5.30	1.60	2.80	1.10	.60	.70	.70	.20	.10	2.00	.10
19	1.10	3.80	1.50	2.60	1.10	.60	.60	.40	.20	.10	1.20	.00
20	.90	3.00	1.20	2.50	1.00	.60	.60	.40	.20	.10	.70	.70
21	1.00	2.70	1.30	2.50	1.00	.50	.60	.40	.10	.10	.50	1.50
22	1.00	2.40	2.30	2.20	1.00	.50	.60	.40	.10	.10	.30	1.00
23	.90	2.20	7.50	2.10	.90	.50	.50	.40	.10	.00	.30	.60
24	.90	2.00	6.80	2.00	.90	.40	.40	.30	.10	.00	.30	.60
25	1.00	1.80	4.20	2.10	.80	.40	.40	.20	.10	.00	.30	.00
26	.90	1.60	3.30	4.20	.80	.40	.40	.10	.10	.00	.30	1.50
27	.90	1.60	2.80	4.40	.80	.60	.20	.10	.10	.00	.30	1.50
28	.90	3.00	2.50	4.40	.70	.60	.20	.10	.10	.00	.00	1.00
29	1.30	.....	2.30	3.60	.70	.70	.10	.10	.10	.00	.10	.90
30	1.60	.....	2.20	3.50	.80	.70	.10	.20	.10	.00	.20	.80
31	1.60	.....	4.10	.....	.80	.....	.40	.40	.....	.10	.....	.60

Rating table for South Fork of Holston River at Bluff City, Tenn., from January 1, to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	176	2.4	2,235	4.8	5,760	7.2	15,140
.1	213	2.5	2,345	4.9	6,030	7.3	15,560
.2	253	2.6	2,455	5.0	6,320	7.4	15,980
.3	304	2.7	2,570	5.1	6,630	7.5	16,400
.4	366	2.8	2,685	5.2	6,950	7.6	16,820
.5	433	2.9	2,800	5.3	7,290	7.7	17,240
.6	503	3.0	2,915	5.4	7,650	7.8	17,660
.7	576	3.1	3,030	5.5	8,030	7.9	18,080
.8	654	3.2	3,145	5.6	8,430	8.0	18,500
.9	737	3.3	3,260	5.7	8,840	8.1	18,920
1.0	825	3.4	3,375	5.8	9,260	8.2	19,340
1.1	915	3.5	3,490	5.9	9,680	8.3	19,760
1.2	1,010	3.6	3,605	6.0	10,100	8.4	20,180
1.3	1,105	3.7	3,720	6.1	10,520	8.5	20,600
1.4	1,200	3.8	3,840	6.2	10,940	8.6	21,020
1.5	1,300	3.9	3,970	6.3	11,360	8.7	21,440
1.6	1,400	4.0	4,110	6.4	11,780	8.8	21,860
1.7	1,500	4.1	4,270	6.5	12,200	8.9	22,280
1.8	1,600	4.2	4,440	6.6	12,620	9.0	22,700
1.9	1,700	4.3	4,620	6.7	13,040	9.1	23,120
2.0	1,800	4.4	4,810	6.8	13,460	9.2	23,540
2.1	1,905	4.5	5,020	6.9	13,880	9.3	23,960
2.2	2,015	4.6	5,250	7.0	14,300	9.4	24,380
2.3	2,125	4.7	5,500	7.1	14,720		

Above 5.70 feet gage height rating table same as 1900-1902.

Estimated monthly discharge of South Fork of Holston River at Bluff City, Tenn., for 1903.

[Drainage area, 828 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
January	2,915	737	1,195	1.44	1.66
February	24,380	825	3,319	4.01	4.18
March	16,400	1,010	3,110	3.76	4.33
April	5,020	1,800	3,127	3.78	4.22
May	3,375	576	1,166	1.41	1.63
June	737	366	522	.63	.70
July	2,915	213	593	.72	.83
August	576	213	366	.44	.51
September	366	213	237	.29	.32
October	304	176	209	.25	.29
November	1,800	176	364	.44	.49
December	1,300	176	447	.54	.62
The year	24,380	176	1,221	1.48	19.78

WATAUGA RIVER NEAR ELIZABETHTON, TENN.

This station was established May 11, 1903, by E. W. Myers, assisted by B. S. Drane. The station is located on the Virginia and Southwestern Railroad bridge at Siam, about 4 miles from Elizabethton, Tenn. The standard inclosed chain gage is located on the downstream side of the middle span on the inside of the guard rail. The zero of the scale is opposite a point 142 feet from the initial point for soundings. The length of the chain from the end of the weight to the marker is 22.66 feet. It is read once each day by J. B. Nave. Discharge measurements are made on the lower side of the bridge, to which the gage is attached. This bridge crosses the river at an angle of 14° with the normal to the direction of the current. The initial point for soundings is the top of the first bolt on the downstream guard rail over the middle of the left abutment. The channel is straight for 1,000 feet above and below the station. The right bank is high and will overflow only at flood stages. All water will, however, pass under the bridge and the trestle approach. The left bank is a perpendicular masonry abutment and will not overflow. The section underneath the bridge is smooth and consists of sand, silt, and some small rocks, and does not appear to be shifting. At ordinary stages the channel is divided into three parts by the bridge piers. At flood stages there is an additional flood channel on the right bank. A shallow stretch 1,000 feet below the bridge makes the current under the bridge sluggish at low stages. Bench mark No. 1 is a standard

copper bolt set in the cap of the abutment on the left bank, upstream side of the bridge. When the gage reads zero its elevation is 21.11 feet above the water surface. Bench mark No. 2 is the upper edge of the plate connecting the lower bracing system with the lower chord and floor beam opposite the middle of the gage box on the downstream side of the bridge. This floor beam is the fourth from the left end of the middle span. When the gage reads zero its elevation is 19.60 feet above the water surface. During the summer and fall of 1902 a line of levels was run from Carter's station, Tennessee, near the mouth of the river, to a point near Shulls mill, in North Carolina, near the head of the river, locating the water powers of this stream. These powers are numerous and of considerable magnitude, but at present are comparatively inaccessible and hence not commercially available.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Watauga River near Elizabethton, Tenn., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 11	E. W. Myers	2.00	665
July 3	B. S. Drane	1.61	234
August 15	M. R. Hall	1.38	328
Do	B. S. Drane	1.38	205
September 5	do	1.25	247
Do	do	1.25	226
October 17	do	1.20	204
November 23	do	1.26	214
February 10	E. W. Myers	2.80	1,095

Mean daily gage height, in feet, of Watauga River near Elizabethton, Tenn., for 1903.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.80	1.75	1.55	1.30	1.15	1.15	1.20
2		1.90	1.65	1.75	1.25	1.15	1.15	1.20
3		1.80	1.65	2.20	1.25	1.10	1.20	1.20
4		1.85	1.75	1.75	1.30	1.10	1.25	1.20
5		1.80	1.75	2.20	1.25	1.10	1.45	1.25
6		2.45	1.75	1.90	1.20	1.10	1.45	1.20
7		2.70	1.85	1.70	1.20	1.10	1.35	1.20
8		2.80	1.70	1.60	1.20	1.20	1.20	1.20
9		2.05	1.55	1.50	1.20	1.70	1.20	1.20
10		2.00	1.55	1.45	1.20	1.30	1.20	1.20
11	1.95	1.90	1.65	1.50	1.60	1.25	1.20	1.20
12	1.95	2.00	1.60	1.55	1.40	1.20	1.20	1.15
13	1.90	1.85	3.00	1.50	1.25	1.20	1.15	1.20
14	2.00	1.80	3.00	1.40	1.20	1.15	1.20	1.40
15	1.95	1.75	2.10	1.40	1.20	1.15	1.20	1.25

Mean daily gage height, in feet, of Watauga River, etc.—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.95	1.75	1.80	1.35	1.20	1.15	1.20	1.15
17	1.85	1.70	1.75	1.40	1.85	1.20	1.20	1.15
18	1.80	1.65	1.70	1.40	1.60	1.30	2.20	1.15
19	1.85	1.60	1.60	1.35	1.35	1.30	1.50	1.15
20	1.80	1.60	1.65	1.35	1.25	1.25	1.30	1.40
21	1.80	1.65	1.55	1.35	1.25	1.20	1.30	2.00
22	1.80	1.65	1.55	1.30	1.25	1.20	1.25	1.60
23	1.75	1.65	1.50	1.30	1.20	1.20	1.25	1.40
24	1.70	1.70	1.50	1.30	1.20	1.15	1.25	1.40
25	1.70	1.60	1.45	1.25	1.20	1.15	1.25	1.40
26	1.70	1.50	1.40	1.25	1.20	1.15	1.25	2.10
27	1.65	1.85	1.40	1.25	1.20	1.15	1.20	1.40
28	1.65	1.80	1.40	1.25	1.20	1.10	1.15	1.70
29	1.65	2.10	1.35	1.20	1.20	1.10	1.20	1.50
30	1.75	1.95	1.40	1.25	1.15	1.15	1.20	1.50
31	1.80	.....	1.50	1.30	.....	1.20	.....	1.30

Rating table for Watauga River near Elizabethton, Tenn., from May 11 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.1	200	1.6	430	2.1	708	2.6	993
1.2	231	1.7	485	2.2	765	2.7	1,050
1.3	273	1.8	540	2.3	822	2.8	1,107
1.4	323	1.9	596	2.4	879	2.9	1,164
1.5	376	2.0	652	2.5	936	3.0	1,221

Lower part of curve is uncertain on account of low velocity of stream.

Estimated monthly discharge of Watauga River near Elizabethton, Tenn., for 1903.

[Drainage area, 408 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second-feet per square mile.	Depth in inches.
May 11–31	652	457	544	1.33	1.04
June	1,050	376	573	1.40	1.57
July	1,221	298	489	1.20	1.38
August	765	231	368	.90	1.04
September	568	216	268	.66	.73
October	485	200	233	.57	.66
November	765	216	270	.66	.74
December	708	216	300	.74	.85

MISCELLANEOUS MEASUREMENTS IN TENNESSEE RIVER DRAINAGE BASIN.

Valley River.—The following discharge measurements were made on this stream:

Discharge measurements of Valley River at Murphy, N. C.

Date.	Gage height, Hiwassee gage.	Discharge.
	Feet.	*Second-feet.*
August 27	5.0	63
Do	5.0	84
December 4	4.9	58

Fightingtown Creek.—This stream was measured at wagon bridge 7 miles northwest of Blueridge, Ga. The bench mark is top of bridge floor at right-bank pier, downstream side of bridge.

Discharge measurements of Fightingtown Creek at wagon bridge 7 miles northwest of Blueridge, Ga., 1903.

Date.	Height of bench mark above water.	Discharge.
	Feet.	*Second-feet.*
July 16	9.60 below B. M	132
July 19	9.80 below B. M	114
August 13		79
December 7	Measured at mouth of creek, G. H. McCays, 0.53	61

Little Tennessee River.—At wagon bridge at McGhee, Tenn., this stream was discharging 2,103 second-feet on August 24, 1903, when the water surface was 38.48 feet below top of upstream end of first crossbeam from left-bank pier.

Other streams.—The following miscellaneous measurements have been made in the Tennessee River drainage basin:

Miscellaneous measurements in Tennessee River drainage basin.

Date.	Stream.	Locality.	Discharge.
			Second-feet.
July 20	Big Spring	Tuscumbia, Ala	177.0
Aug. 11	Hampton Creek	Mineralbluff, Ga	73.0
Aug. 12	Charley Creek	Green's mill, near Blueridge, Ga.	14.0
Dec. 2	do	do	3.5
Do	do	One-half mile below Green's mill, near Blue Ridge, Ga.	3.2
Aug. 27	Hanging Dog Creek	Murphy, N. C	48.0
Dec. 2	do	do	26.0
Do	Weaver Creek	Near Blueridge, Ga	3.7
Dec. 5	Martins Creek	Murphy, N. C	4.0
Dec. 9	Ellijay River	Ellijay, Ga	6.07

YAZOO RIVER DRAINAGE BASIN.

Yazoo River rises in the northwestern part of Mississippi. It flows south just west of the central portion of the State and enters the Mississippi River just above Vicksburg. The United States Geological Survey is maintaining a station on this river at Yazoo City under the direction of M. R. Hall.

YAZOO RIVER AT YAZOO CITY, MISS.

A gage has been maintained at this point by the Engineer Corps of the Army. It was replaced in 1901 by a new gage rod in three sections, marked with brass figures and brass tacks, the sections being placed as follows: The lowest, marked from −3 to +4.5 feet, is attached to the protecting work of the bridge; the middle section, marked from 4.5 to 18.5 feet, is attached to the piling that protects the bridge pier; the uppermost section, continuing the graduation up to 32.3 feet, is on a post under the approach to the bridge. The highest known water occurred in 1882, reaching a gage height of 36.5 feet; the lowest occurred on October 15 to 17 and 20 to 22, 1896, with a gage height of −2.8 feet. The danger line is at 25 feet.

Discharge measurements are made from the highway bridge consisting of one span of 85 feet, a turn-span of 190 feet, an approach on the right bank of about 100 feet, and on the left bank of about 1,200 feet. This is the bridge to which the gage is attached, and is located one-half mile northwest from the Illinois Central Railroad station in Yazoo City. The initial point for soundings is the end of the iron bridge on the left bank, downstream side. The channel is straight for about 3,000 feet above the station and is curved for about 2,000 feet below. The current is moderately rapid. As this stream is connected with the Mississippi River both above and below the station, it is influenced by the stage of that stream to the extent that high-water measurements are of no value. The bed is of sand and mud and is subject to some change. The right bank is high, but overflows for several hundred miles at extreme floods; the left bank is high and overflows to the foot of the hill about one-half mile from the river. There are trees along both banks.

A bench mark was established on the top of the upstream cylinder of the second pier from the left bank, at a distance of 85 feet from the initial point for soundings, which is on the downstream end of iron bridge on the left bank. The elevation of the mark is 35.85 feet above the zero of the gage. Other important bench marks in Yazoo City are the following: P. B. M. 12, Yazoo City, is a copper bolt in stone under ground, surmounted by an iron pipe and cap, in the north corner of the county court-house yard. It is 44.1 feet above the zero of the gage and 116.2 feet above mean sea level. P. B. M. 13, Yazoo City, is a copper bolt in stone under ground, surmounted

by an iron pipe and cap, in the north corner of the public school yard, near Washington and Main streets. It is 29.2 feet above the zero of the gage and 101.3 feet above mean sea level. The observer is P. C. Battaille. Daily gage heights are furnished by the Weather Bureau.

The observations at this station during 1903 have been made under the direction of M. R. Hall, district hydrographer.

Discharge measurements of Yazoo River at Yazoo City, Miss., in 1903.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 13	J. M. Giles	5.80	4,755
September 23	do	−2.00	1,623

Mean daily gage height, in feet, of Yazoo River at Yazoo City, Miss., for 1903.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.40	17.30	24.10	28.60	22.00	6.70	16.90	−0.60	0.50	−2.20	−2.50	−2.20
2	18.00	17.20	24.20	28.60	21.80	6.50	16.80	− .60	.40	−2.20	−2.50	−2.10
3	18.00	19.00	24.40	28.60	21.40	6.70	16.50	− .50	.20	−2.20	−2.50	−2.10
4	18.10	19.00	24.60	28.60	21.00	7.40	16.00	− .50	− .40	−2.20	−2.50	−2.10
5	18.40	18.50	24.70	28.70	20.70	8.30	15.50	− .50	− .60	−2.30	−2.50	−2.20
6	18.70	18.20	24.80	28.70	20.30	9.20	14.80	− .40	− .90	−2.30	−2.50	−2.30
7	18.90	19.70	24.90	28.70	20.00	10.00	13.90	− .30	−1.00	−2.30	−2.50	−2.30
8	19.00	22.40	25.20	28.70	19.80	10.90	12.50	− .20	−1.20	−2.30	−2.50	−2.30
9	19.00	21.90	25.30	28.60	19.50	11.50	11.00	− .10	−1.30	−2.30	−2.50	−2.30
10	19.00	21.80	25.40	28.50	19.20	12.40	9.60	− .10	−1.40	−2.30	−2.50	−2.30
11	19.40	22.40	25.80	28.40	19.00	13.00	8.20	1.00	−1.50	−2.30	−2.50	−2.30
12	19.40	22.00	25.90	28.30	18.40	13.50	6.90	1.00	−1.60	−2.40	−2.40	−2.40
13	19.30	21.90	26.00	28.20	18.50	14.10	6.00	.90	−1.70	−2.40	−2.30	−2.30
14	19.30	21.90	26.20	28.00	18.00	14.70	5.00	.90	−1.70	−2.40	−2.20	−2.20
15	19.30	22.00	26.40	27.80	17.50	15.00	4.00	1.40	−1.70	−2.40	−2.10	−2.20
16	19.20	23.10	26.50	27.50	16.90	15.50	3.50	1.60	−1.80	−2.40	−2.00	−2.20
17	19.00	23.40	26.60	27.20	16.20	15.80	2.80	1.80	−1.80	−2.40	−1.90	−2.20
18	19.00	23.30	26.80	26.90	15.50	16.00	2.40	1.80	−1.80	−2.40	−1.90	−2.10
19	18.90	23.30	26.90	26.60	14.50	16.20	2.00	2.00	−1.80	−2.40	−2.10	−2.00
20	18.80	23.30	27.00	26.30	13.40	16.30	1.80	2.50	−2.00	−2.40	−2.10	−1.80
21	18.60	23.30	27.20	25.90	12.00	16.40	1.50	1.80	−2.00	−2.40	−2.20	−1.60
22	18.40	23.40	27.50	25.50	10.80	16.50	1.20	1.50	−2.10	−2.40	−2.30	−1.40
23	18.10	23.50	27.60	25.00	9.50	16.60	1.00	1.50	−2.20	−2.40	−2.30	−1.20
24	18.00	23.60	27.80	24.70	8.80	16.70	.80	1.50	−2.20	−2.40	−2.30	− .20
25	17.80	23.60	27.90	24.30	8.20	16.90	.50	1.50	−2.20	−2.40	−2.30	.80
26	17.60	23.70	28.00	23.90	7.80	17.00	.50	1.50	−2.20	−2.40	−2.30	1.60
27	17.50	23.80	28.20	23.50	7.60	17.10	.40	1.40	−2.20	−2.40	−2.30	1.90
28	17.80	24.10	28.30	23.00	7.50	17.10	.00	1.30	−2.20	−2.40	−2.30	2.10
29	17.60	.....	28.40	22.80	7.40	17.10	− .20	1.20	−2.20	−2.40	−2.30	2.30
30	17.50	.....	28.50	22.50	7.20	17.10	− .40	1.00	−2.20	−2.40	−2.30	2.50
31	17.40	.....	28.60	.....	6.90	.....	− .50	.80	.....	−2.40	.....	2.50

Rating table for Yazoo River at Yazoo City, Miss., from January 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−2.5	1,730	.4	2,440	5.0	4,440	15.0	14,000
−2.4	1,750	.6	2,500	5.2	4,580	15.5	14,500
−2.3	1,770	.8	2,560	5.4	4,720	16.0	15,000
−2.2	1,790	1.0	2,620	5.6	4,860	16.5	15,500
−2.1	1,810	1.2	2,690	5.8	5,000	17.0	16,000
−2.0	1,830	1.4	2,760	6.0	5,150	17.5	16,500
−1.9	1,850	1.6	2,830	6.5	5,550	18.0	17,000
−1.8	1,870	1.8	2,900	7.0	6,000	18.5	17,500
−1.6	1,915	2.0	2,970	7.5	6,500	19.0	18,000
−1.5	1,940	2.2	3,050	8.0	7,000	19.5	18,500
−1.4	1,965	2.4	3,130	8.5	7,500	20.0	19,000
−1.3	1,990	2.6	3,210	9.0	8,000	20.5	19,500
−1.2	2,015	2.8	3,300	9.5	8,500	21.0	20,000
−1.1	2,040	3.0	3,390	10.0	9,000	22.0	21,000
−1.0	2,065	3.2	3,480	10.5	9,500	23.0	22,000
− .9	2,090	3.4	3,570	11.0	10,000	24.0	23,000
− .8	2,115	3.6	3,660	11.5	10,500	25.0	24,000
− .7	2,140	3.8	3,760	12.0	11,000	26.0	25,000
− .6	2,165	4.0	3,870	12.5	11,500	27.0	26,000
− .4	2,215	4.2	3,980	13.0	12,000	28.0	27,000
− .2	2,265	4.4	4,090	13.5	12,500	29.0	28,000
+ .0	2,320	4.6	4,200	14.0	13,000		
.2	2,380	4.8	4,320	14.5	13,500		

Rating table for 1903 same as 1902.

Estimated monthly discharge of Yazoo River at Yazoo City, Miss., for 1903.

[Drainage area, 8,580 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Second feet per square mile.	Depth in inches.
January	18,400	15,400	17,432	2.03	2.34
February	23,100	16,200	20,807	2.43	2.53
March	27,600	23,100	25,442	2.97	3.42
April	27,700	21,700	25,753	3.00	3.35
May	21,000	5,910	14,075	1.64	1.89
June	16,100	5,550	12,610	1.47	1.64
July	15,900	2,190	6,549	.76	.88
August	3,170	2,165	2,593	.30	.35
September	2,470	1,790	1,953	.23	.26
October	1,790	1,750	1,760	.21	.24
November	1,850	1,7 0	1,767	.21	.23
December	3,170	1,750	2,089	.24	.28
The year	27,700	1,730	11,068	1.29	17.41

BIG BLACK RIVER DRAINAGE BASIN.

MISCELLANEOUS MEASUREMENTS.

Big Black River was measured at the Illinois Central Railroad trestle at Morey, Miss., on July 13, when it had a discharge of 491 second-feet. The bench mark is the downstream end of cap, 110 feet from left-bank end of trestle, and the water surface was 25.25 feet below bench mark.

On July 14 the same stream was measured at Illinois Central Railroad trestle, 1 mile north of Way, Miss. The bench mark is downstream end of cap, 240 feet from north end of trestle. Water surface was 15.75 feet below bench mark, and the discharge was 1,391 second-feet.

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